

MOSES

WITH HAND-LENS AND MICROSCOPE

A NON-TECHNICAL HAND BOOK OF
THE MORE COMMON MOSSES OF THE
NORTHEASTERN UNITED STATES

PART V

BY

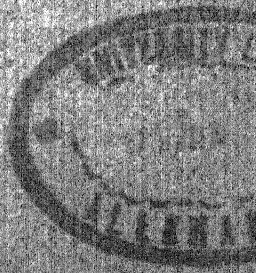
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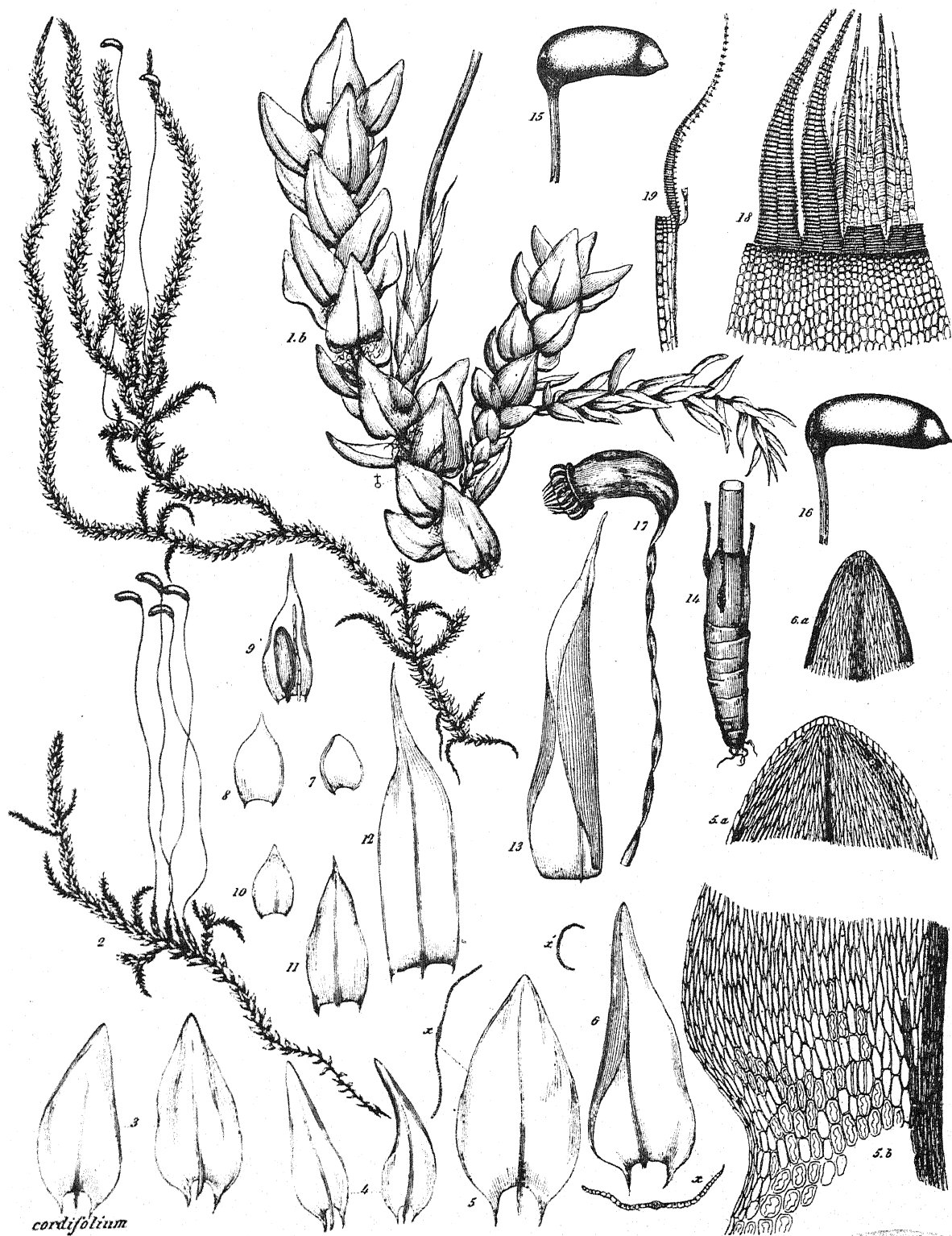


PLATE LXXVI. *Calliergon cordifolium* (From Bry. Eur.)

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transparent leaves, which are broad, obtuse, *incurved at apex* and very concave, closely imbricated, glossy, lightly plicate, entire or slightly crenulate at apex; branch leaves narrower and more pointed; costa double, short and indistinct; median leaf cells linear, 10-15:1; apical and basal shorter and broader, all rather thick-walled and *somewhat porose*; alar abruptly subquadrate, enlarged and hyaline or colored: dioicous; capsules rather sparingly produced as a rule, sub-

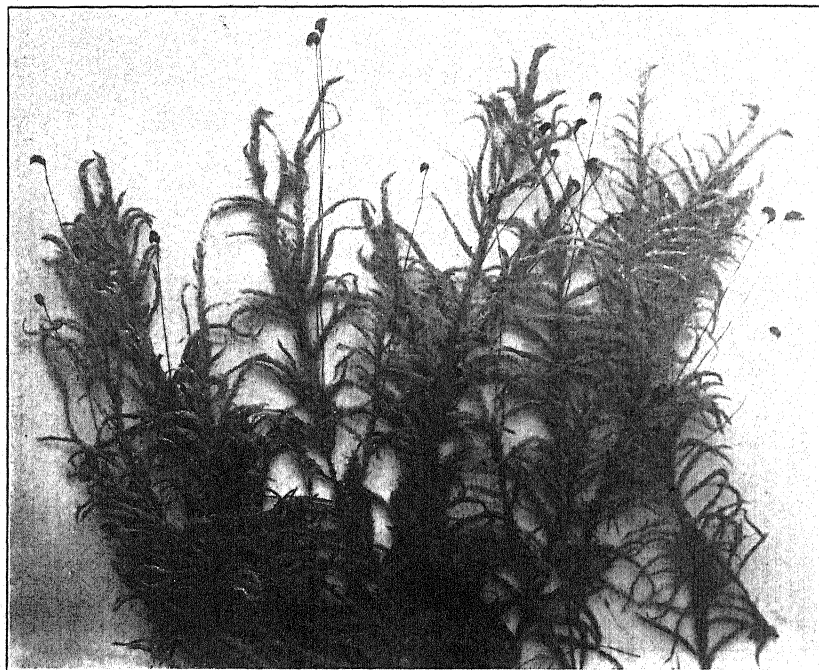
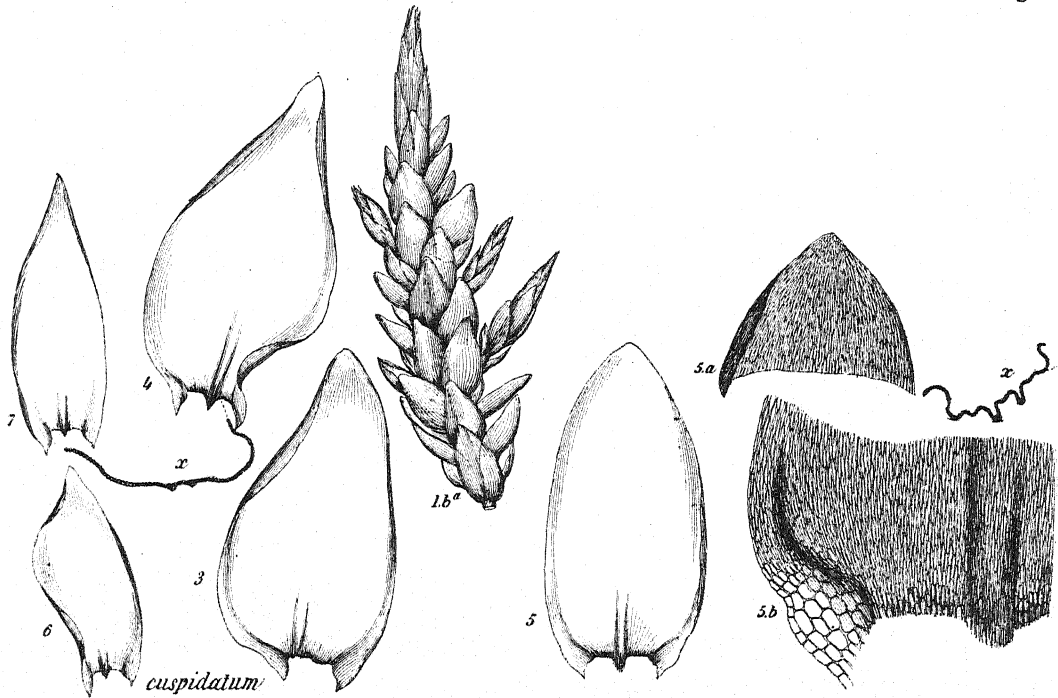


FIGURE 166. *Calliergon Schreberi* $\times 1$

cylindric, arcuate and inclined; *annulus none*; spores in autumn. In dry sterile situations this species sometimes becomes stouter, dark green and much more closely and regularly pinnate than the specimens photographed.

C. cuspidatum (L.) Kindb. A plant of wet meadows and swamps, more slender than the last, irregularly pinnate; leaves more distant and more spreading below, *but closely convolute at the tips of stems and branches, making them cuspidate*; *outer layer of stem cells large, thin-walled and hyaline*; leaves broadly elliptic-oblong, *broad and rounded at apex*, concave-cucullate, entire, ecostate or costa short and double; median leaf cells linear-flexuose, 15-20:1; alar suddenly enlarged, thin-walled, hexagonal, hyaline or colored: dioicous; capsule strongly arcuate and *sulcate* when dry and empty; *annulus large*; spores in summer. Easily distinguished from the last by the cuspidate stems and branches and the large outer stem cells. Floating forms may become very robust and beautifully pinnate.

FIGURE 167. *Calliergon cuspidatum* (From Bry. Eur.)

CAMPYLIUM (Sulliv.) Bryhn

Plants growing in moist places, frequently in or near water, usually over earth or stones (except *C. hispidulum*). The genus is closely allied to *Amblystegium*, from which it differs in the longer leaf cells and typically squarrose to squarrose-recurved leaves. The leaves are rarely somewhat secund, never falcate-secund or circinate. Branching usually irregular. Central strand of few cells. Leaves broadly lanceolate to ovate-lanceolate, usually long-acuminate and decurrent; alar cells somewhat differentiated, quadrate to hyaline-inflated. Costa usually single, double or lacking in some species, never percurrent or excurrent. Capsules inclined to horizontal, curved and usually contracted under the mouth when dry and empty. Annulus present; peristome perfect.

KEY

- | | |
|--|------------------------|
| 1. Leaves strongly squarrose | 2. |
| Leaves not noticeably squarrose | 4. |
| 2. Leaves strongly costate | <i>chrysophyllum</i> . |
| Leaves without costa or with costa short and double | 3. |
| 3. Plants very slender; alar cells not conspicuously enlarged or inflated | <i>hispidulum</i> . |
| Plants stouter; alar cells conspicuously enlarged and inflated | <i>stellatum</i> . |
| 4. Stem leaves cordate-ovate, abruptly slenderly acuminate; dioicous | <i>radicale</i> . |
| Stem leaves broadly lanceolate, gradually narrowed to a very long slender acuminate; monoicous | <i>polygamum</i> . |

Amblystegium Juratzkanum and *A. Kochii* may be sought in *Campylium*, but their leaves are spreading from the base and not bent, consequently they will lie flat on a slide while the species of *Campylium* most likely to be confused with them will not do so.

Plagiothecium striatellum may be sought here, as it has the appearance of a *Campylium*, but the stem is without central strand, the leaves are serrate and the capsules strongly striate when dry.



FIGURE 168. *Campylium hispidulum* (From Sulliv. "Icones") .10. Perichaetial leaf.

C. hispidulum (Brid.) Mitt. Plants slender, interlaced in bright green tufts over roots of trees, decaying wood, etc., near the ground in moist shaded places; stems creeping, freely and irregularly branching; stem leaves reaching 0.75mm long, widely spreading to squarrose, *triangular-heart-shaped*, rather abruptly narrowed to an acumen equaling the rest of the leaf in length, somewhat concave, *subserrulate all around, decurrent, excavate*; costa very short and double or

lacking; median leaf cells 6μ wide and 3-6 times as long; basal cells shorter, subquadrate; alar cells numerous, $9-12\mu$ in diameter: monœcious; capsule cernuous to horizontal; annulus simple; peristome perfect, cilia nearly as long as the segments and somewhat appendiculate; spores in summer. Frequent but not occurring in large quantities as a rule. Distinguished from all our other species by its small size (about that of *Amblystegium serpens*) and slender stems and branches.

I frequently find a form apparently growing in drier places that has its leaves closer together and branch leaves shorter-acuminate and more strongly serrulate and leaf cells shorter than figured by Sullivant. To this form I have tentatively given the name *forma compácta*, type from Hempstead, Long Island, Dec. 1, 1899. Coll. A. J. G.

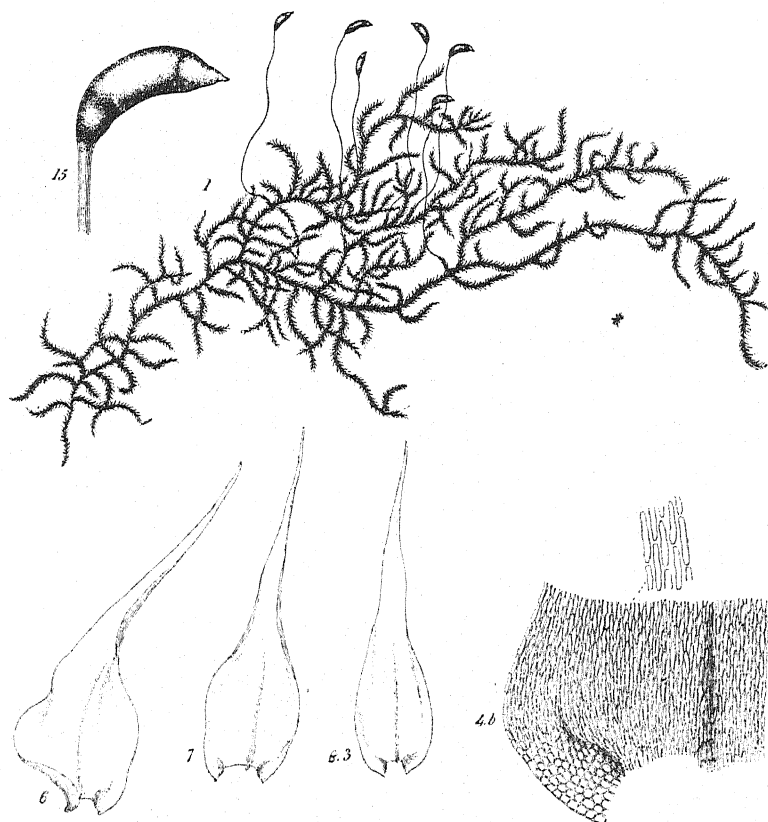


FIGURE 169. *Campylium chrysophyllum* (From Bry. Eur.)

C. chrysophyllum (Brid.) Bryhn. Plants slender, creeping, irregularly and diffusely to subpinnately branching, forming thin loose mats in some cases, in others cespitose; leaves squarrose-spreading from a somewhat clasping base, occasionally somewhat secund in varietal forms; stem leaves cordate-ovate to

cordate-triangular, decurrent, abruptly narrowed to a long, slender, somewhat channeled acumen, $1.3-1.5 \times 0.4-0.5$ mm typically entire or slightly denticulate at base; branch leaves narrower, lanceolate to ovate-lanceolate; costa single, reaching the middle or beyond; leaf cells $5-9\mu$ wide and 4-6 times as long; typically with a group of small subquadrate alar cells as shown in Fig. 169: dioicous; spores in early summer. Common everywhere. Growing over earth and stones in moist places. Varying greatly in robustness and density of tufts, length of costa, length and slenderness of acumen, spreading of leaves, smoothness of margin and size of capsule. In Europe this species is said to intergrade with the next, but intergrading forms in America seem less frequent. We have forms of undoubted *chrysophyllum* with costa very short in some of the leaves and with alar cells somewhat enlarged, also *stellatum* with some of the leaves distinctly unicostate. In these intermediate plants the length of costa often varies greatly on the same plant. It is not impossible that some of these forms are hybrids.

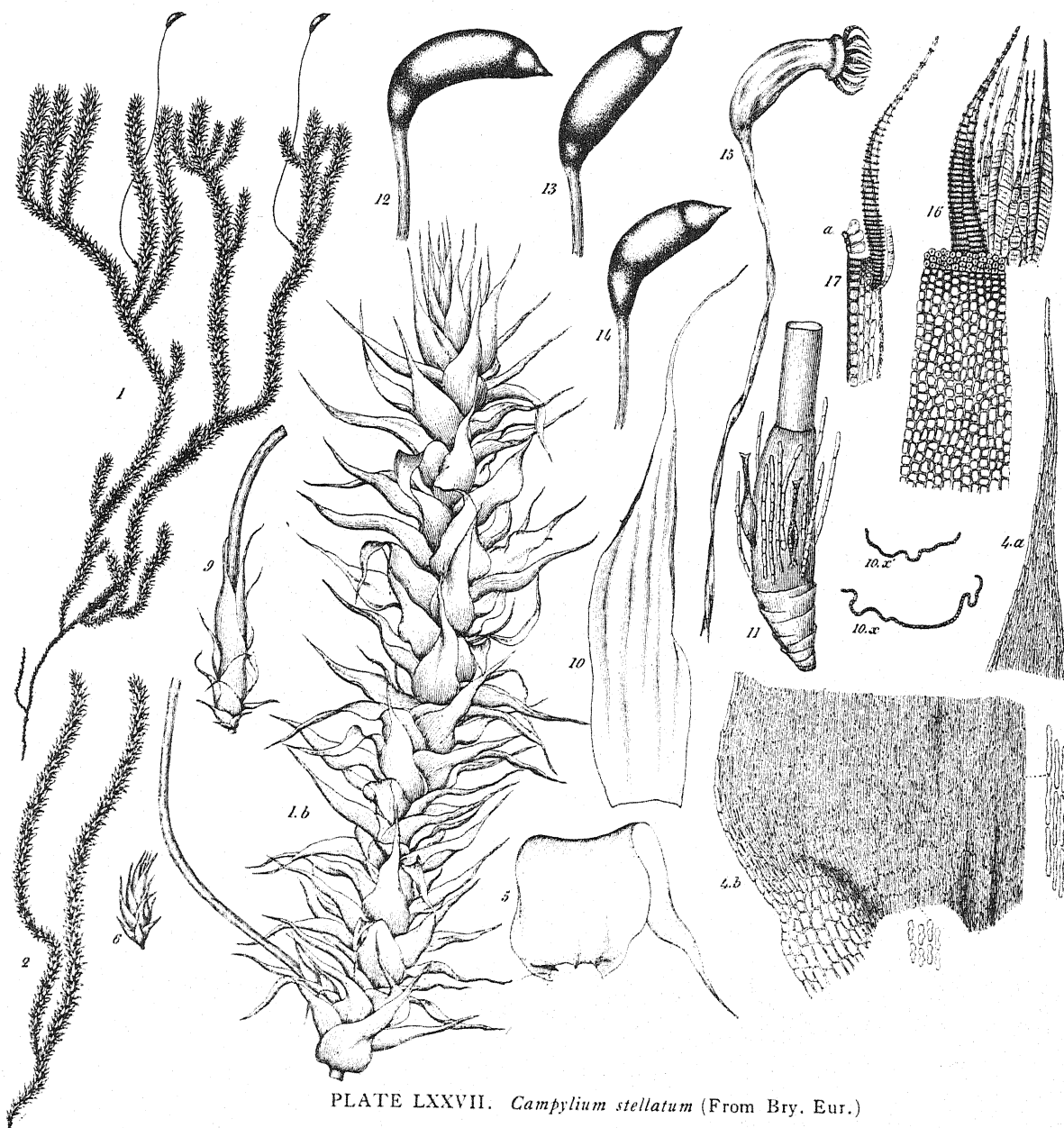
While we have forms of *chrysophyllum* that are practically identical with the European plant, yet by far the greater number of plants that I have examined have branch leaves with a broader and rather shorter acumen which is sinuate to subserrulate, and leaf cells rather broader in proportion to their length. The very young leaves are often serrate at apex. These forms culminate in var. *brevifolium* and I have designated them as *forma intermedia*. *Hypnum unicostatum* C. M. & Kindb. of Macoun's Canadian Musci No. 840 and No. 132 of my N. American Musci Pleurocarpi, also Austin's Musci App. Nos. 394 and 395 are *forma intermedia*.

Var. *brevifolium* (R. & C.) (var. *Carolinianum* Grout). Very robust; leaves more or less falcate, somewhat secund in the type, more gradually and less slenderly acuminate, many plainly serrulate at apex. N. Am. Musci Pl. No. 313 is this variety.

**C. radiale* (P. Beauv.) (*Hypnum radicale* P. Beauv. non *Amblystegium radicale* B. & S., *H. Bergenense* Austin, *Hypnum bygrophilum* Jur., *H. chrysophyllum* var. *tenellum* L. & J. non B. & S.).

As may be inferred from the tangled synonymy given above, this plant has had an interesting history (See Bryologist for Nov., 1909). Although it so closely resembles forms of *Amblystegium Kochii* as to be confused with it by good students, I believe Austin was right in regarding it as a close relative of *C. chrysophyllum*. It is a slender, lax, unbranched or little-branched plant, growing in springy or partially inundated places over decaying leaves, etc. The leaves are very distant, not squarrose, merely spreading, not otherwise very different in typical forms from the stem leaves of *C. chrysophyllum*. The leaves differ from those of related *Amblystegia* in being broadly cordate-ovate and decurrent, sub-

*See Fig. 175 for illustration.



clasping at base so that the leaf base does not lie flat when the leaf is removed entire and mounted, and in the longer, thinner-walled, less chlorophyllose leaf cells, those at basal angles being rather abruptly enlarged and hyaline or nearly so, apex often somewhat channelled. The costa is well developed; leaf cells of middle of leaf 6-10:1. The capsules are not at all distinctive and might belong to *Campylium* as well as to *Amblystegium*. From *C. chrysophyllum* it differs chiefly in its lax habit, distant leaves and little-branched plants, resembling in gross appearance *Amblystegium* rather than *Campylium*. Small forms of *Drepanocladus aduncus* Kneiffii are distinguished by their more strongly excavate leaf bases and more inflated alar cells; the leaves are usually less abruptly acuminate. I believe this species is common, as I have picked out many specimens from my collection masquerading under several specific names.

C. stellatum (Schreb.) Bryhn. This is a much more robust moss than *C. chrysophyllum*, and grows in thick tufts in swamps. Stems stout, erect or ascending, 5-10cm long;

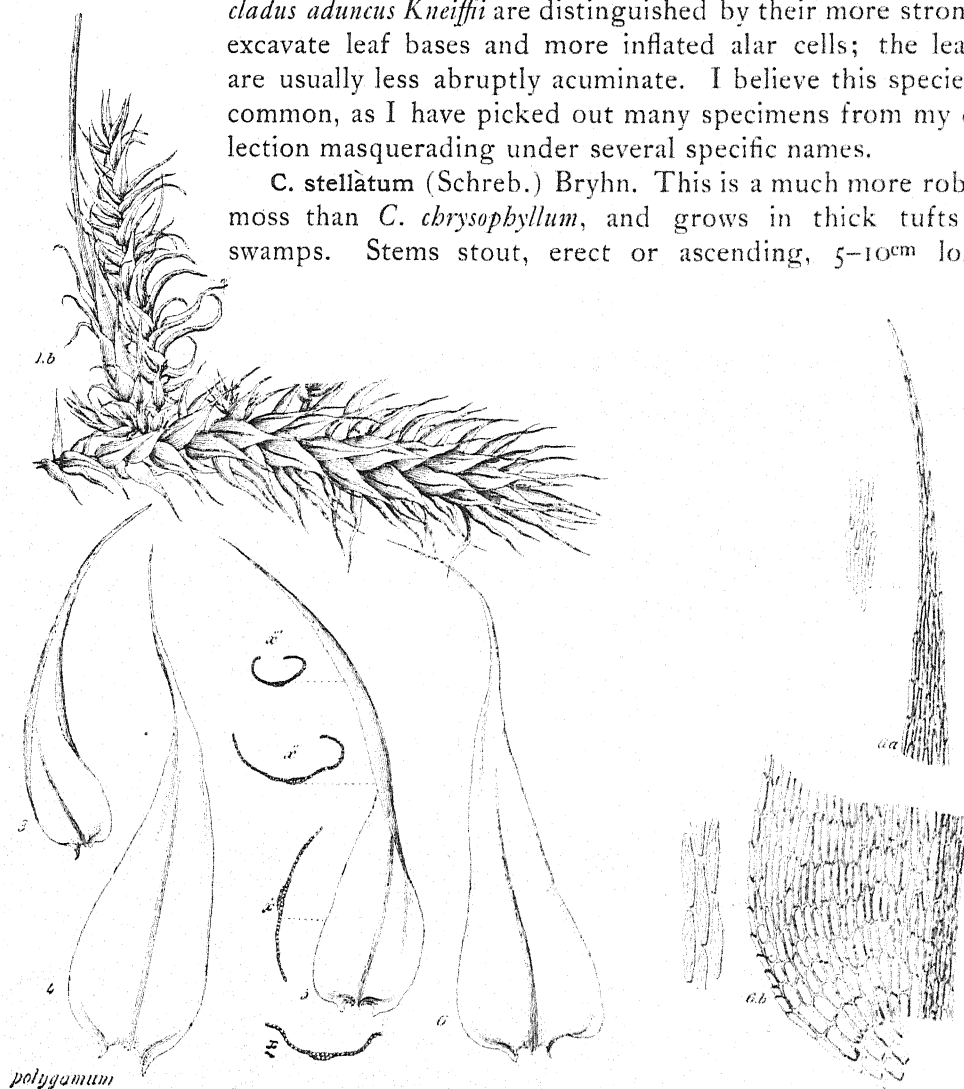


FIGURE 170. *Campylium polygamum* (From Bry. Eur.)

leaves typically entire with apex somewhat channeled, *strongly squarrose to recurved*, without costa or at most with merely a trace of one; inflated alar cells numerous and conspicuous, hyaline or colored: dioicous; spores in summer, but infrequently produced. This species is apparently not abundant but is widely distributed in our range. Forms are found varying toward *C. chrysophyllum* and having a well-developed costa in leaves.

Var. *protensum* (Brid.) Roehl is reported from our region, though I am not familiar with it. It is slender, more or less procumbent and creeping; leaves more distant, smaller, more abruptly and more longly and finely acuminate from a distinct cordate-ovate base, with angular cells smaller and fewer (*vide* Dixon).

C. polygamum (B. & S.) Bryhn is apparently a rare or infrequent species with us. It is rather smaller than the last; leaves narrower, erect-open, *not squarrose, entire, with a long, slender, somewhat channelled acumen*; costa extending well above the middle; *leaf cells narrowly linear*, the alar enlarged and distinct, forming auricles; basal cells enlarged nearly to the costa: autoicous or synoicous: annulus present, cilia well developed; spores in summer. Swamps, wet meadows, etc.

Distinguished from *Amblystegium riparium* by the inflorescence, auricled base and channeled acumen. From forms of *Drepanocladus aduncus*, by its usually narrower leaf base, its scarcely decurrent, not secund leaves, and by its inflorescence.

AMBLYSTEGIUM B. & S.

Mostly small moisture-loving mosses, growing on various substrata; variously colored, dark green to yellowish, sometimes blackish in the older portions, not glossy. Stems creeping, branching freely and irregularly; central strand present, few-celled. Leaves spreading to erect when dry, mostly equally spreading, but occasionally somewhat secund, more or less decurrent, lanceolate to ovate, acute to long-acuminate, strongly costate, flat or concave, but not plicate, margins plane. Leaf cells short, often less than 5:1 (longer in *A. vacillans* and *A. riparium*); basal cells shorter and broader and parenchymatous; alar often somewhat enlarged, but not abruptly so, not inflated or forming auricles except *A. filicinum*. Paraphyllia few or more often wanting. Nearly always monoicous. Seta long, smooth; *capsules often large in comparison with the gametophyte*, inclined to horizontal, elongated and *usually strongly curved and constricted under the mouth when dry and empty*; operculum conical, not rostrate; annulus usually present; peristome perfect. The genus as here defined does not include the small species having ecostate leaves. They belong in the *Hypneæ*.

The short leaf cells and long capsules, together with the usually small size of the plants, render this genus fairly easy of recognition, but the species, like

most aquatic and subaquatic mosses, are exceeding variable and puzzling and also apparently intergrade in many instances.

Brachythecium reflexum might be mistaken for an *Amblystegium*, but when in fruit its short capsule and rough seta will distinguish it. A careful study of the genus has brought me to believe that *Cratoneuron filicinum* is a true *Amblystegium*, (*A. filicinum* (L.) De Not.) because of its close relationship to forms of *A. irriguum*. It is, in most instances, readily distinguished by its abundant paraphyllia and inflated alar cells. I have also concluded that *Hypnum Lescurii* Sulliv. is better treated in a separate genus, *Sciaromium Lescurii* (Sulliv.) Broth., because of its marked character of bordered leaves.

KEY

1. Leaves with a distinct border joined with the costa at apex (See *Sciaromium*).
Leaves not bordered 2.
2. Paraphyllia abundant, alar cells inflated. (See *Cratoneuron filicinum*.) . . .
Paraphyllia few or wanting, alar cells not distinctly inflated 3.
3. Costa percurrent or nearly so, or excurrent 4.
Costa ending well below the apex, usually not far above the middle 10.
4. Costa excurrent 5.
Costa not excurrent 6.
5. Plants larger; leaves broad, gradually narrowed to the very stout excurrent costa *noterophilum*.
Plants smaller; leaves narrower and acuminate, ending in a much narrower excurrent costa *irriguum spinifolium*.
6. Very slender, densely tufted; leaves finely and sharply denticulate; median leaf cells 6-10:1 *compactum*.
Larger; leaves entire or at most obsoletely denticulate; median cells 3-6:1 . 7.
7. Stem leaves entire, cordate-ovate to oblong-lanceolate, apex rather blunt; all forms aquatic 9.
Stem leaves narrower in outline, usually acute with a more slender acumen; growing in water or wet places 8.
8. Aquatic, submerged except at low water; basal leaf cells usually plainly enlarged; costa very stout *irriguum*.
Growing in wet places but not often submerged; basal cells much less differentiated; costa more slender and apex usually more slenderly acuminate. *varium*.
9. Stem leaves oblong-ovate to broadly oblong-lanceolate, 1-2^{mm} in length, gradually and evenly narrowed to a rather blunt apex *fluviale*.
Stem leaves ovate to cordate-ovate, usually less than 1.2^{mm} long, more abruptly narrowed to a distinct acumination *orthocladon*.
10. Median leaf cells reaching 10:1 or longer 13.
Median leaf cells less than 8:1 11.
11. Leaves widely spreading when dry; marginal cells at base of leaf oblong to rectangular 12.
Leaves not widely spreading; marginal cells at base quadrate or transversely elongated *serpens*.

12. Stem leaves 1^{mm} in length or less, rarely more, ovate-lanceolate *Juratzkanum*.
 Stem leaves more than 1^{mm} in length; leaves broadly ovate-lanceolate to
 cordate-ovate *Kochii*.
 13. Stem leaves narrowly elongated-lanceolate; apical cells shorter, apex blunt *vacillans*.
 Stem leaves ovate to ovate-lanceolate; apical cells little if any shorter,
 apex acute *riparium*.

The genus as here constituted divides itself pretty clearly into four subgenera.

Euamblystegium Broth., of which *A. serpens* is the center. Slender plants, not aquatic; leaf cells 2-6:1 rarely longer; costa slender, reaching to the middle of the leaf or a little farther (to the apex in *compactum*).

This group includes *serpens*, *Juratzkanum*, *Kochii* and *compactum*. *Kochii* is usually put with the next group, but its nearness to *Juratzkanum* and its wide leaf cells convince me that it belongs here.

Leptodictyum Schimp. contains *A. riparium* and its allied species *vacillans*, *Floridanum* R. & C., *brevipes*, *laxirete* and *brachyphyllum* (the last three recently described from the West by Cardot and Theriot). M. Cardot admits that all these are subspecies of *riparium* and, to my mind, all except possibly *vacillans* and *Floridanum* are much better regarded as varieties or even mere forms and are not described here. The group is characterized by a generally aquatic or subaquatic habitat, long, narrow leaf cells, 8:1, sometimes 10-15:1, and the costa ending at about the middle of the leaf.

Hygroamblystegium Loeske, which Brotherus makes a separate genus, contains *varium*, *irriguum*, *fluviale*, *orbicladon*, *noterophilum* and *filicinum*, and is characterized by aquatic habitat (excl. *varium*) and stout, percurrent or excurrent costa; leaf cells 2-4:1, occasionally 6:1, thick-walled; paraphyllia present in many species. I have become convinced that *Hypnum filicinum* L. belongs in *Amblystegium* because it intergrades with *irriguum* so that some forms are next to impossible to locate definitely.

Sciaromium Mitt. includes *Lescurii*. This, with 16 other known exotic species of *Sciaromium*, undoubtedly should be treated as a separate genus, but it was discovered too late to insert in keys.

The different species have a way of being closely interwoven so that one often gets two or three species in the same tuft. It is very necessary to bear this in mind when distributing or comparing material.

A. serpens (L.) B. & S. Plants slender, the smallest of our species, growing in rather thin, more or less densely interwoven mats, irregularly branching, not glossy; leaves moderately close together as a rule, not widely spreading; stem leaves ovate-lanceolate, long-acuminate, reaching 1.2 x 0.4^{mm}, but usually smaller, branch leaves smaller and lanceolate, both serrulate to entire, narrowed at the insertion and slightly decurrent; costa slender, reaching to the middle of the leaf or somewhat farther; median leaf cells oblong-hexagonal to hexagono-

rhomboidal, 3-4:1, broader and subrectangular toward the base, *quadrate to transversely elongate at the basal margin*: autoicous; seta 15-30^{mm} long; capsule cylindric, curved and cernuous, contracted below the mouth when dry and empty; annulus of 2-3 rows of cells; spores in spring.

Common on moist substrata, ground, stones and especially decaying wood. Very variable in size; several European varieties are described. We have var. *tenu*e (Schrad.) B. & S., which is so distinct as to merit notice. It is exceedingly slender, filiform; leaves distant, shorter and smaller; seta short, capsule small, nearly straight.

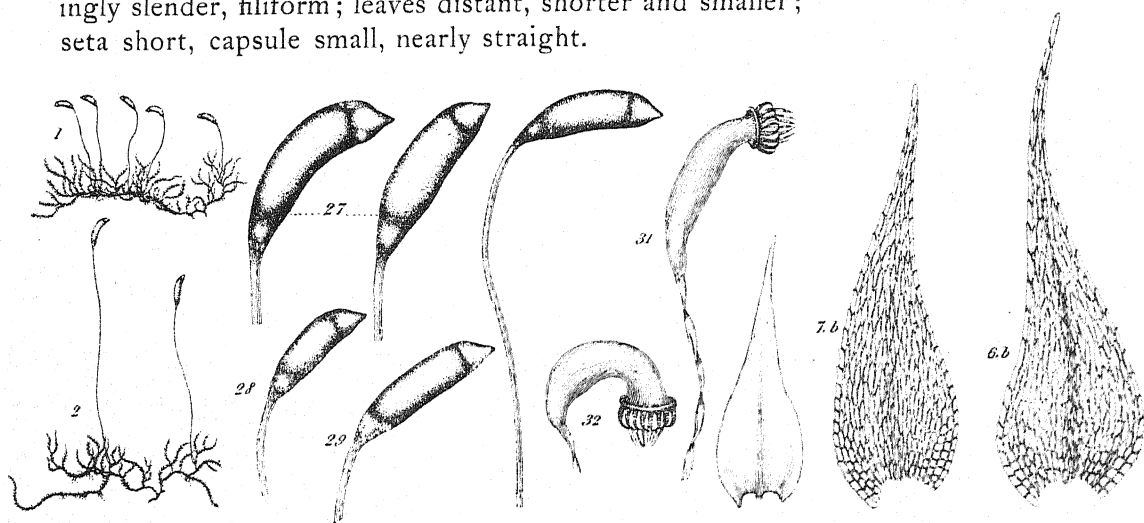


FIGURE 171. *Amblystegium serpens*. (From Bry. Eur.) 1 and 2. Plant natural size. 27 to 32. Capsules. 6b and 7b. Leaves. The angular cells are usually shorter, and some are broader than long.

The short, broad leaf cells distinguish *A. serpens* from mosses of other genera that may resemble it superficially. Small forms of *A. varium* with costa not quite percurrent and large forms of *serpens* approach each other, but I have never seen *serpens* with the costa as long and strong as in *varium*.

A. Juratzkanum Schimp. is, in my opinion, a large variety of *serpens*, with some nondescript forms included by various authors. Exceedingly variable in size, ranging from forms the size of *serpens* to those difficult to distinguish from *Kochii*. Leaves larger than in *serpens*, *widely spreading both wet and dry*, narrowly long-acuminate, more or less serrulate; cells of the basal margins rectangular, longer than broad, 1.5-2:1. Frequent; probably often overlooked.

While the rather artificial distinction of the length of the alar cells usually holds as between this species and *serpens*, I have seen leaves with one side having cells of *serpens* and the other those of *Juratzkanum*. *Juratzkanum* is distinguished from *Kochii* by its smaller size and its resemblance to *serpens*.

A. compactum (C. Muell.) Aust. About the size of *serpens*, light green, yellowish *within the dense tufts*, which may be 25^{mm} deep, but are usually thinner;

leaves erect, open, about 1mm long, narrowly decurrent, lanceolate to ovate-lanceolate, gradually long acuminate, finely denticulate throughout, teeth at base frequently recurved and double as in Fig. 172; costa percurrent or nearly so, very thin, frequently bearing delicate brood filaments from the back or apex; branch leaves narrower and smaller; seta short; capsule small, erect or slightly inclined, nearly or quite symmetric. On decayed wood or at bases of trees in swamps or along streams.

Widely distributed across the northern United States and in Canada and not rare. One of the easiest species to recognize under the microscope. Some densely growing forms of *serpens* simulate its macroscopic appearance.

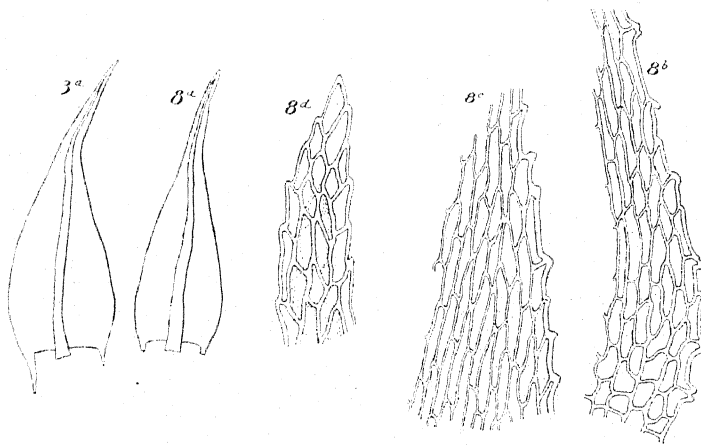
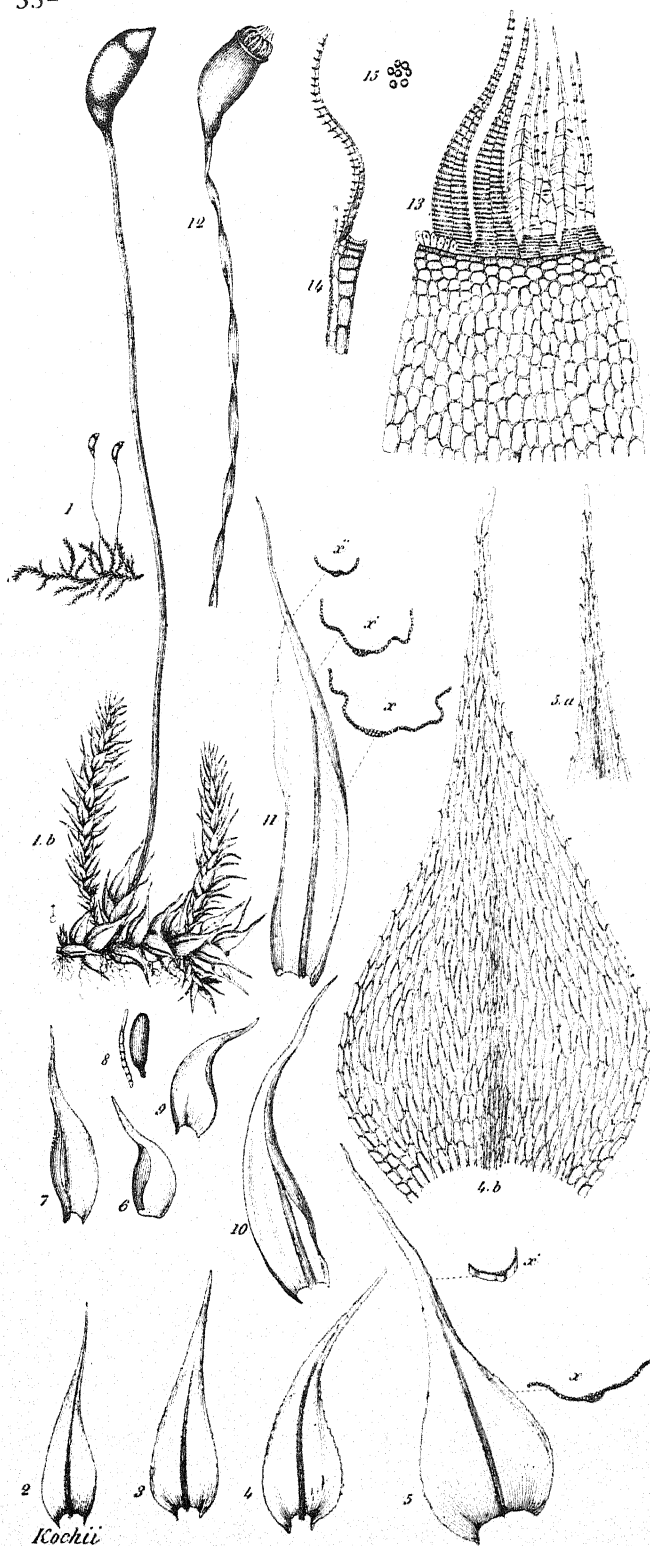


FIGURE 172. *Amblystegium compactum* (From Cheney in Botanical Gazette).
3a. Leaves, 3b, 3c, and 3d, apical, basal and median cells, respectively.

A. Kóchii B. & S. Smaller plants resemble *A. Juratzkanum*, the larger *A. riparium*, in appearance; leaves rather distant, spreading from the point of insertion, at times almost squarrose, again, in drier situations, erect-spreading, giving the plants the appearance of *A. varium*; stem leaves ovate to ovate-lanceolate, somewhat narrowed at the insertion, long and slenderly acuminate, entire, sinuate or serrulate, 1-1.5mm long; costa extending $\frac{2}{3}$ - $\frac{3}{4}$ the length of the leaf; leaf cells strongly chlorophyllose, rhomboid-hexagonal, 4-6:1, rectangular and hyaline or slightly colored at base but not forming auricles; branch leaves smaller and more narrowly lanceolate; spores in summer. Common in shaded marshy places.

I have yet to see any plants with leaves as broadly cordate-ovate as are figured in the Bryologia Europea (Fig. 4b). A rather narrow-leaved form common in swampy shaded places, on the Atlantic coast at least, has been referred to *Campylium chrysophyllum* and to *C. radiale*, from both of which it clearly differs in its non-decurrent, non-clasping leaf base. Similar European forms are referred to *Kochii* by the best authorities. It has also been referred to *A. Juratzkanum*



and *A. varium* according to specimens in my collection. Plants of *A. varium*, with costa reaching scarcely beyond the base of the acumination, are found and are likely to be referred to *Kochii*, but the costa, even in such cases, is much stronger, the cell walls thicker and the cells themselves rather smaller, especially at the basal margin and near it.

A. varium (Hedw.) Lindb. Plants in mats of varying density, thin and loose to almost cespitose, younger portions light green, darker below the surface; stem leaves rather close together, loosely erect-spreading, averaging 1.2×0.5 mm, reaching 1.4×0.57 mm in large plants, broadly ovate to ovate-lanceolate, narrowed at the insertion and somewhat decurrent, rapidly narrowed to a long and comparatively slender acumen, entire or nearly so, slightly concave but lying nearly flat when removed entire; costa strong, tapering, reaching the apex or nearly so, rarely stopping at base of acumen; leaf cells rhomboid-hexagonal, 2-4:1, somewhat rounded at the ends, toward the base becoming rectangular, subquadrate at basal margins, those near the

FIGURE 173. *Amblystegium Kochii*
(From Bry. Eur.)

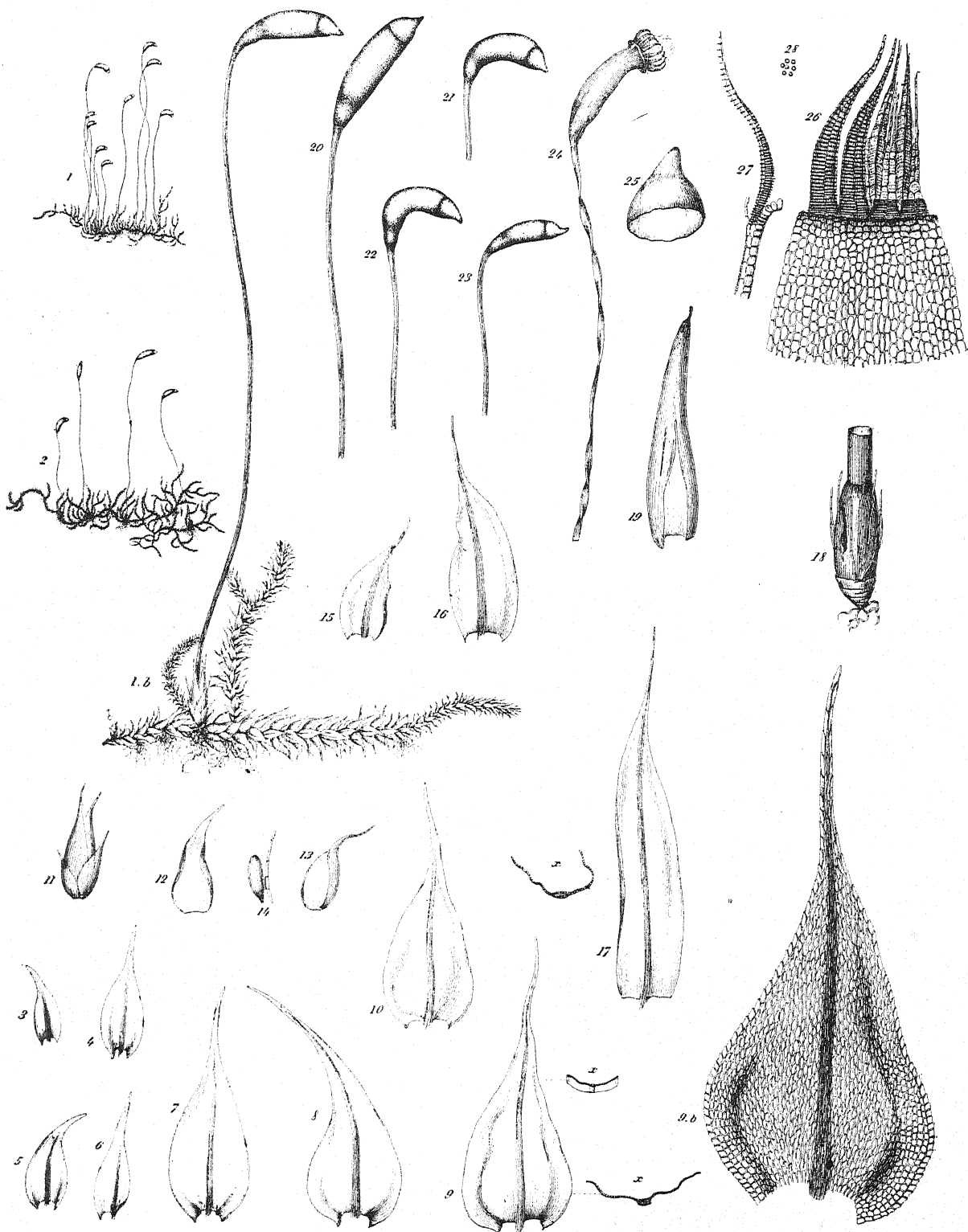
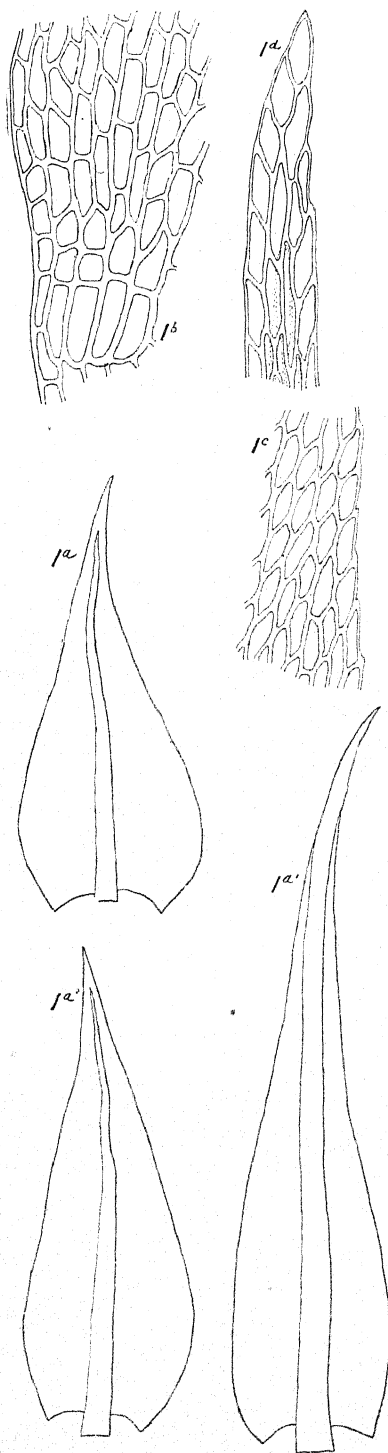


PLATE LXXVIII. *Amblystegium varium* (From Bry. Eur.)



insertion occasionally slightly colored but not opaque; branch leaves much smaller and less slenderly acuminate; spores in spring. Common in moist shaded places, on soil, at base of trees, decaying wood, or even on stones. Variable, especially in size, and often mixed with other species.

Distinguished from *serpens* and *Kochii* as noted under those species. It grades into *irriguum* by such minute degrees that there are indeterminate plants, but in general *irriguum* is known by its less slender apex and stouter less tapering costa.

Forma ovata Grout, has stem leaves smaller, more concave, round-ovate, abruptly and narrowly short acuminate, with nearly the outline of *Tbelia asprella*; quadrate alar cells very numerous extending up $\frac{1}{3}$ the margin of the body of the leaf. Type from near St. Louis, Mo., growing with *Eurhynchium hians* and *Mnium cuspidatum*. Differs from *A. orthocladon* in its more slender costa, more slender acumination and lack of highly colored opaque basal cells and in its very different habitat.

A. irriguum (Wils.) B. & S. Typically aquatic, growing on stones in the bed of streams, also found along the edges of streams, ponds, etc., and in swampy places; deep olive to blackish green; stems rather thick and tough with a few paraphyllia particularly near the insertion of branches; stem leaves elongated deltoid-ovate to ovate-lanceolate, gradually long-acuminate with apex acute, 1-1.5mm long, more or less narrowed to the insertion and slightly decurrent; branch leaves smaller and narrower; all rather thick and rigid, sinuolate to entire; costa very thick and strong throughout, percurrent or merging into the

FIGURE 174. *Amblystegium irriguum*. 1a. Leaves $\times 42$. 1b, 1c and 1d. Basal, median and apical cells of same $\times 290$. 1a'. Leaf of var. *spinifolium* $\times 42$. (From Cheney in Botanical Gazette)

apex; one or more rows of basal cells enlarged, rectangular, usually thick-walled and colored, cells above these quadrate to short-oblong, becoming rhomboid-hexagonal above, 2-4:1 (Boulay and Dixon say 4-6:1), rather thick-walled and more opaque than in the preceding species; spores in summer. Common, but the typical form appears rare both here and abroad. It grades into *varium* from which it is distinguished as noted under that species. It grades into *orthocladon* which is at best only a subspecies, intermediate between *irriguum* and forma *brevifolia* of *fluviatile*. *Orthocladon* has shorter, broader, pointed leaves altogether different in outline from typical *irriguum*. *Fluviatile* has the costa still stouter, especially at the apex, and the leaves subobtuse and less narrowly acuminate.

Var. *spinifolium* Sch. More robust than the species; stems 3-12 cm in length; leaves longer and narrower, reaching 1.8 mm in length with a thick long-excurrent costa; upper leaf cells 6-8:1, basal areolation looser. Distinct from *A. noterophilum* by its narrower leaves and costa only about $\frac{1}{2}$ as wide.

There is a floating aquatic moss about the size of var. *spinifolium* and with a similar areolation but with leaves often broadly ovate and sometimes reaching 2 mm in length, and with the costa much thinner and vanishing in the apex or below, that probably is this species. In general appearance it resembles var. *spinifolium* because of its large size, but in leaf outline and areolation and numerous paraphyllia it resembles forms of *A. filicinum* (*Cratoneuron*, p. 315). This form differs from *filicinum* in its floating unbranched habit and enlarged basal and alar cells, gradually merging into those above.

My N. Am. Musci Pleurocarpi Nos. 247 and 291 are this form. M. Dupret, the collector, suggests for this form the name forma *Marianopolitana*.

A. fluviatile (Sw.) B. & S. Plants aquatic, floating, with long parallel branches, dark green or blackish; stem leaves oblong-lanceolate to oblong-ovate, *not so much broader below as in most species*, scarcely narrowed to the insertion, not decurrent, *more gradually tapering to a blunt point, entire*, concave and occasionally plicate; *costa very stout, percurrent and merged into the apex, typically nearly or quite as broad above as below*; area of enlarged and rectangular cells at base larger than in the preceding, *these basal cells thick-walled and often colored*, opaque or pellucid; median and upper cells hexagonal-rhomboid, 4-6:1, or even longer, *very chlorophyllose and more or less indistinct*; capsules very long, narrowly cylindric, suberect, somewhat unsymmetric but scarcely arcuate before dehiscence, after dehiscence more curved, strongly contracted under the mouth when dry; spores in summer.

Boulay separates the species into two forms: Forma *typica* with leaves $2 \times \frac{2}{3}$ mm, oblong-lanceolate, loosely imbricate, often somewhat plicate, lower cells little colored. This form is apparently infrequent. The Bry. Eur. plate represents Boulay's forma *typica*. Forma *brevifolia*; leaves oblong-ovate, $1-1.4 \times \frac{1}{2}$ mm tapering to a wide subobtuse apex, concave, basal cells often deeply colored

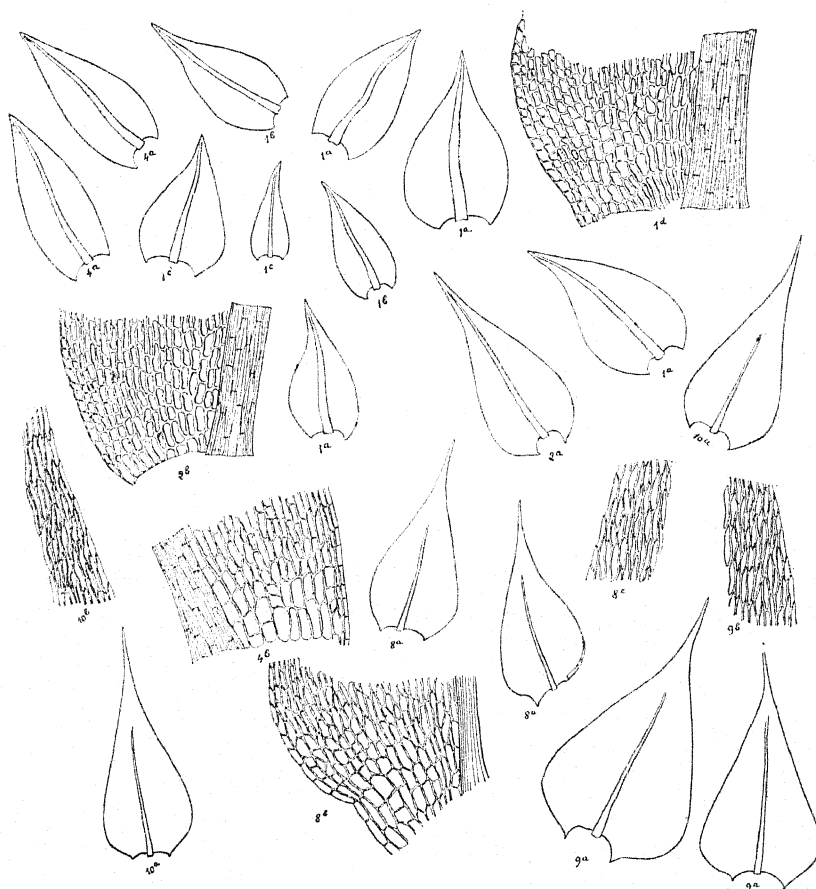


FIGURE 175. 1. *Hypnum orthocladon* P. B. *a.* Four leaves $\times 30$, from a specimen in the herbarium of Schwaegrichen from North America and communicated by Palisot. *b.* Two leaves $\times 30$ from a specimen in the herbarium of Schwaegrichen; collected by Muhlenberg in North America. *c.* Two leaves $\times 30$ from a specimen in the herbarium of Schwaegrichen; collected in Cuba by Pöppig. *d.* Lower portion of a leaf $\times 135$. 2. *Leskea varia* Hedw. ($=A. varium$) from Pennsylvania (Muhlenberg). *a.* A leaf $\times 30$. *b.* Lower part of the same $\times 135$. (From an "original" specimen.) 4. *Hypnum fluviatile* Sw. *a.* Two leaves $\times 30$. *b.* Lower portion of one of these leaves $\times 135$. (From an "original" specimen communicated to Hedwig by Schwartz and preserved in the herbarium of the former.) 8. *Hypnum radicale* P. B. from North America (Palisot and Richard). *a.* Three leaves $\times 30$. *b.* Lower portion of one of these leaves $\times 135$. *c.* Cells from the middle portion of the same $\times 135$. (From specimens in the herbarium of Schwaegrichen.) 9. *Hypnum Bergenense* Austin, from Closter, New Jersey. (Austin "original" specimen.) *a.* Two leaves $\times 30$. *b.* Middle portion of one of these leaves $\times 135$. 10. *Amblystegium hygrophilum* Sch. from Germany. *a.* Two leaves $\times 30$. *b.* Middle portion of one of these leaves $\times 135$.

These figures and their descriptions are taken from M. Cardot's valuable "Revision of the Types of Hedwig and Schwaegrichen" published in the "*Bulletin de l'Herbier Boissier*," in 1899. The specimens marked as "original" were evidently communicated or furnished by the authors, and though not types in every case certainly should be regarded as authentic. It should be remembered, however, that in those early days of inferior microscopes material was often mixed and the authors of species themselves had mixtures in their types. M. Cardot's figures have been presented as being as near authenticity as anything available. The figure of *H. Bergenense* fails to show the characteristic concavity of the base as shown in Austin's Musci Appalachianiani No. 39r.

and opaque. According to M. Cardot's figures of specimens supposed to be from the type locality this is probably the typical form (see Fig. 175) and it certainly is the more common form with us. It grades into the form which M. Cardot believes to be *A. orthocladon* (P. B.) and which is clearly intermediate between this species and the last, merging into both with such a series of intergrading forms that it is impossible to tell where one leaves off and the other begins. Almost identical plants have been referred to *irriguum* by Cheney and to *fluviale* by Renauld. Until the position of these forms can be better determined, I have included them under,

A. orthocladon (P. B.) Kindb. Leaves broadly cordate-ovate, either gradually narrowed to a subobtusate apex or somewhat acuminate in Fig. 175. Stems more freely branching with shorter branches; stem leaves shorter in most all cases; one or more rows of basal cells enlarged, thick-walled and usually opaque and colored; median leaf cells as short as in *irriguum*. Common on stones in brooks in the elevated regions of New England at least, and probably common throughout our range.

A. noterophilum (Sulliv.) Warnst. is a large (2-15cm long) moss, harsh and rigid to the touch, forming close thick tufts when growing out of water, and crowded floating masses in the water; leaves varying from broadly triangular-cordate-ovate in the land forms to long-lanceolate in water forms, reaching 2mm or more in length, but usually shorter, 1-1.5mm, characterized by the very thick, strongly excurrent costa, which is $\frac{1}{2}$ to $\frac{1}{3}$ the width of the leaf at base; lamina commonly of two layers of cells in the basal and costal regions. Growing in and around springs, especially in calcareous regions. Rare and local. Not likely to be confused with anything except the var. *spinifolium* of *irriguum*, which is a smaller plant, having narrower, more slender-pointed leaves with costa $\frac{1}{2}$ as wide.

A. riparium B. & S. is very close to forms of *Drepanocladus aduncus Kneiffii* and certainly bears a marked likeness to forms of *C. polygamum* as well. It is probable that the structure of these three mosses has been modified by their subaquatic habitat along similar lines so that their true relationship is obscured. (See Bryologist for November, 1909.)

The plants are exceedingly variable in size and habit, typically creeping, with long stems, irregularly branched with rather short, spreading branches, forming loose mats over various substrata near water or even floating in water in some of the varieties, reaching 10cm or more in length; stem leaves long, 2-4mm, rather distant, widely spreading both wet and dry, often subcomplanate, rarely somewhat secund at ends of stems and branches, broadly ovate-lanceolate to elongated-lanceolate, shortly decurrent, somewhat excavate, but not auriculate, entire, rarely subserrulate, gradually tapering to a long, slender, flat acumen; branch leaves like stem leaves, but smaller; costa $\frac{1}{2}$ - $\frac{3}{4}$ length of leaf;

leaf cells linear, about 9μ wide and 8–12 (or rarely 15) times as long, thin-walled; basal cells 8μ wide and 2–3 times as long, subrectangular and often hyaline; autoicous; capsules oblong-cylindric, inclined and arcuate; spores in spring. Common in wet places.

For distinctions from *C. polygamum*, see under that species. It is distinguished from forms of *Drepanocladus aduncus* by its inflorescence, and non-auriculate leaves with flat acumen.

Var. *longifolium* (Schultz) B. & S. is one of the larger forms, yellowish green to bright yellow, very slender, little branched; leaves more distant, usually subcomplanate, narrowly lanceolate and reaching 5mm long in floating forms, with a very long, tapering and almost filiform acumen. Probably with the range of the species. Floating forms grading between this and the species are common.

Var. *fluitans* (L. & J.) R. & C. Very robust, 10–20cm long,

floating in shallow water or at the edges of streams; dirty green or yellowish; leaves 0.8×3.2 mm, sometimes reaching 4mm in length and 1mm in width.

Those unfamiliar with these two varieties confuse them because both are floating forms. The very long narrow leaves with long slender acumen distinguish *longifolium*.

The above are our two principal varieties, but the species is so variable that one can scarcely make two collections alike. As in *Drepanocladus*, it is probable that the form is profoundly affected by the amount of moisture present. In spite of all these variations the species is not a hard one to recognize, but the great variations in size are often puzzling. Some of the smaller forms may be confused with *Amblystegium Kochii*, but this last has much shorter leaf cells, leaves more abruptly acuminate and often serrulate above.

A. vacillans Sulliv. is a rare moss closely related to *riparium*, and differing chiefly in the subobtuse apex of the leaves having apical cells rather irregular and

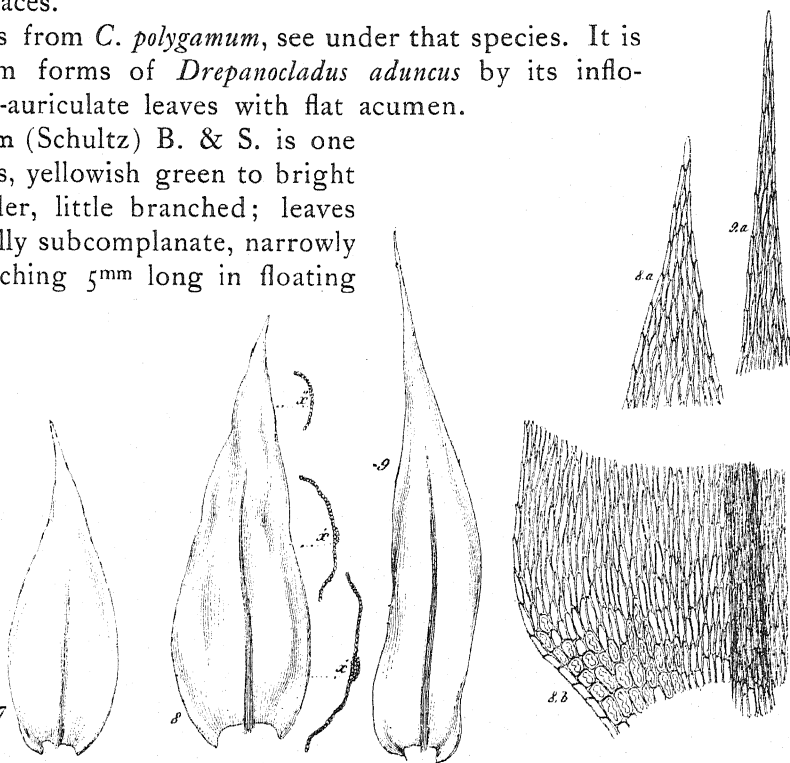


FIGURE 176. *Amblystegium riparium*, leaves and leaf cells. (From Bry. Eur.)

conspicuously shorter and broader than in *riparium*. The stem leaves are narrowly lanceolate, long-acuminate, reaching 2^{mm} in length in large plants; branch leaves oblong-lanceolate, less slenderly acuminate; costa extending above the middle, in the perichaetial leaves excurrent. N. H., Vt., N. J., Ontario. The specimens from Georgia and Florida that have been referred to this species, are, I believe, a different thing, for it is scarcely probable that a subalpine species of the New England mountains should be found in the lowlands of the southern states.



FIGURE 177. *Amblystegium vacillans*. (From Sulliv. "Icones.")

SCIAROMIUM Mitt.

Distinguished from *Hygroamblystegium* chiefly by the strongly bordered leaves and entire lack of paraphyllia. In habitat and gross appearance it is the same, also in the cellular structure of the leaves.

S. Lescurii (Sulliv.) Broth. is our only species. It is a blackish green moss growing on stones in brooks and is common especially in elevated regions in the eastern United States. It often grows associated with *Amblystegium orthocladon* and its leaves are about the same size and shape, so that it can be readily distinguished by a microscopical examination only. The border to the leaves, while plain, is not conspicuous and may be overlooked easily in some cases. Sullivant's figure will supply all needed details of structure. Spores mature in spring.



FIGURE 178. *Sciaromium Lescurii*, leaf and leaf cells. (From Sulliv. "Icones.")

SUBFAMILY 6. HYPNEÆ

Central strand lacking or thin and few-celled; leaves often strongly falcate-secund, without costa or with costa short and double (except *Hygrohypnum* sp.); leaf cells linear-flexuose in most species (rhomboidal to linear-rhomboidal in *Amblystegiella*); capsules oblong to cylindric, typically inclined to horizontal, and unsymmetric to strongly curved, but nearly erect and symmetric in some few species; peristome perfect except in some of the species with erect capsules. This subfamily differs from the last in the slightly developed costa and longer leaf cells. *Hygrohypnum* is a connecting link.

KEY TO THE GENERA

1. Branching often regularly pinnate to plumose; leaves strongly falcate-secund; costa short and double or lacking; alar cells usually strongly differentiated 7.
- Branching irregular; leaves apparently in two rows, complanate costa as in *Hypnum* *Plagiothecium* and *Hypnum pratense*.
- Leaves neither complanate nor strongly secund, or if strongly secund, with a strongly marked costa 2.
2. Leaf cells short, 2-5:1 *Amblystegiella*.
- Leaf cells usually narrowly linear-flexuose 3.
3. Costa usually pronounced; aquatic *Hygrohypnum*.
- Costa faint or lacking 4.

4. Epidermal cells of capsule strongly collenchymatous; operculum beaked *Raphidostegium*.
Epidermal cells of capsule not collenchymatous 5.
5. Alar cells little differentiated *Plagiothecium* species.
Alar cells strongly differentiated, inflated 6.
6. Leaves spreading to squarrose as in *Campylium*; capsules striate. *Plagiothecium striatellum*.
Leaves imbricated; capsules not striate, long-cylindric . . . *Hypnum Haldanianum*.
7. Aquatic; plants very large and tumid; leaves usually obtuse or apiculate *Scorpidium*.
Often growing on wet soil but not aquatic; smaller; leaves acuminate and acute *Hypnum*.

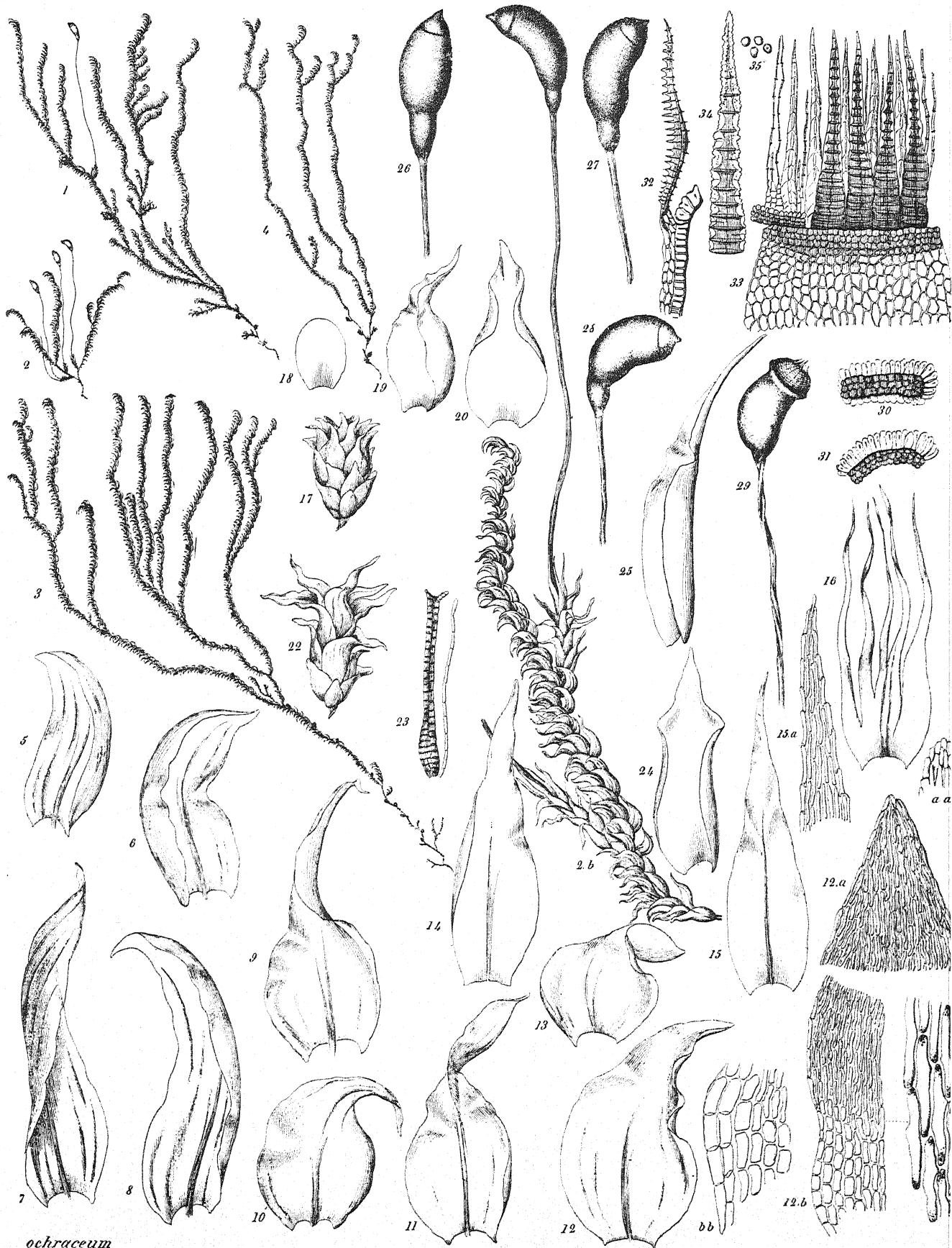
HYGROHYPNUM Lindb.

Aquatic or subaquatic mosses growing on stones in and near the beds of brooks, especially in mountainous regions, often forming extensive mats, more or less filled in below with sand and gravel. Stems mostly creeping or prostrate, with ascending branches; central strand present, usually few-celled. Leaves in most species usually concave, more or less falcate-secund, comparatively short and broad, soft in texture and often obtuse at apex, rarely acutely acuminate, sometimes apiculate, mostly entire or slightly denticulate at apex; costa double, of varying length, or single and forking, sometimes reaching above the middle; alar cells plainly differentiated, hyaline, colored, or subopaque in the various species, often remaining on the stem when leaves are stripped off for examination. Capsules inclined and unsymmetric, rather short and thick; peristome perfect.

Nearest to *Drepanocladus*, from which it is distinguished by its habitat in running streams and its broader concave more obtuse leaves. *Scorpidium* is distinguished from this genus by its gigantic size and rugose leaves; *Calliergon* by its habitat and general appearance. Aquatic *Raphidostegia* are very close to some species of *Hygrohypnum* and Limpricht and Brotherus put *Hypnum Novæ-Cesareæ* Austin in this genus, but in general the alar cells of *Raphidostegium* are more strongly developed, the costa is shorter or wanting, and the operculum rostrate. Certain *Brachythecieæ*, such as *B. plumosum* or *Eurhynchium rusciforme* have a similar habitat and appearance, but are easily distinguished by the acute leaves, strong single costa and rough seta.

KEY

1. Alar cells large and conspicuous, clear, hyaline or colored, forming distinct decurrent auricles; outer layer of stem cells much enlarged. (See Fig. 161) 2.
Alar cells thick-walled, less distinctly inflated, granulose to subopaque, often colored; outer layer of stem cells not enlarged 3.
2. Alar cells hyaline and thin-walled; costa usually reaching the middle of leaf; dioicous. *ochraceum*.
Alar cells usually colored and thick-walled, except the outer row or two, which are usually thin-walled and often hyaline; costa double, short and faint; monoicous. *eugyrium*.



ochraceum

PLATE LXXX. *Hygrohypnum ochraceum* (From Bry. Eur.) 5-15. Leaves. *aa*, *15a*. Apices of leaves. 16. Lacerate leaf. (15 and *15a* are forms rare or wanting with us.)

- | | |
|--|-------------------|
| 3. Leaves serrulate all around | <i>montanum.</i> |
| Leaves entire or denticulate at apex only | 4. |
| 4. Leaves entire; costa single, often forking in <i>palustre</i> | 5. |
| Costa short and double; leaves denticulate at apex | <i>dilatatum.</i> |
| 5. Plants minute; stem leaves oblong-ovate, obtuse, flat | <i>Closteri.</i> |
| Plants larger; leaves concave | <i>palustre.</i> |

H. ochraceum (Turn.) Loeske. Plants large for the genus; stems usually 5-10^{cm} long, soft and flaccid, pale green with often a yellowish tinge; *outer layer of stem cells large and thin-walled*; leaves subsecund or more usually *strongly falcate-secund*, oblong-ovate to oblong-lanceolate, concave, *slightly plicate*, often split when old, narrowed to a longer or shorter *obtuse or subobtusely acumination*, entire except at

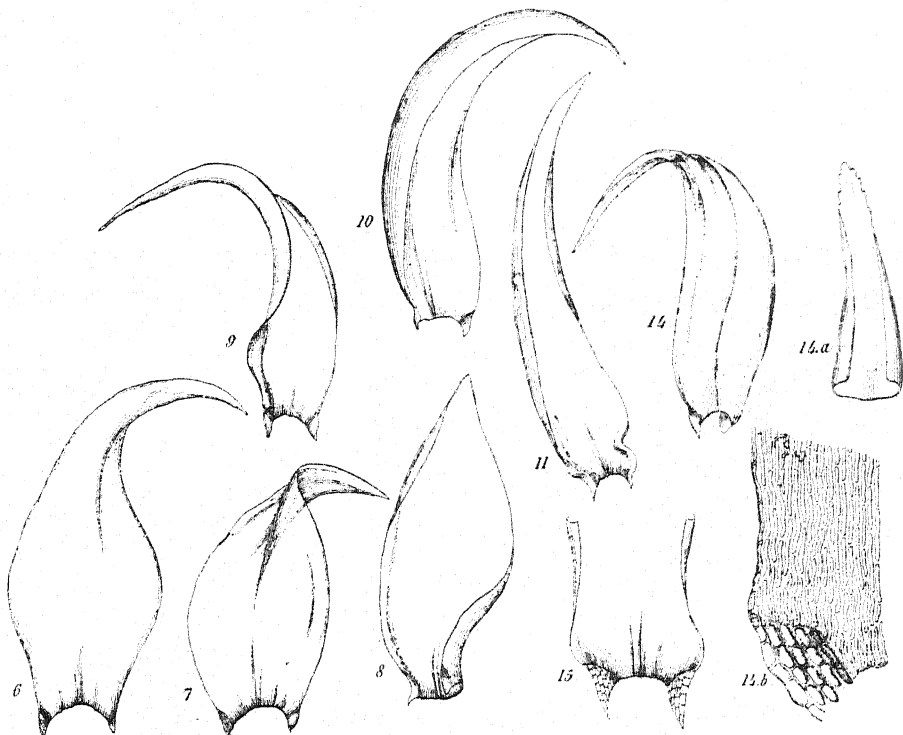


FIGURE 179. *Hygrohypnum eugyrium* (From Bry. Eur.). 6-8. Leaves of stem and principal branches. 9-14. Leaves of other portions of the plants.

the slightly denticulate apex, varying greatly in comparative length and breadth; costa variable, *usually single and reaching the middle or beyond*, sometimes bifid or even trifid and occasionally very short; median leaf cells linear-flexuose, 8-14:1, shorter at apex; basal cells broader and shorter; *decurrent alar cells suddenly enlarged, inflated and hyaline, thin-walled*, frequently a single row of 5 or 6 hyaline cells runs up the basal margin: dioicous; spores in spring or early summer. Our

most common species and exceedingly variable, yet some of the leaves on a plant are almost sure to show the strong costa and obtuse denticulate apex, and all show the hyaline alar cells, which, in most specimens, are more abruptly enlarged to the decurrent auricles than is indicated in the figure. We have varietal forms in which the leaves are not at all falcate or secund or are complanate, but I consider them mainly habitat forms. Almost any mountain stream in northern or central North America will yield this species.

H. eugyrium (B. & S.) Loeske. Plants forming wide dense sand-filled mats on rocks in mountain streams; leaves more or less secund, loosely imbricated and *very concave*, giving the branches a turgid appearance, oblong-ovate, short-acuminate and usually acute, narrowed but not rounded at base, entire or slightly denticulate at apex; *costa double, short and faint*; median leaf cells linear, 8-10:1, shorter at apex; *alar cells suddenly enlarged and inflated, the inner thick-walled and usually colored, the outer thinner walled and often hyaline*: monoicous; spores in spring. Not rare, but apparently most of our plants are

Var. *Máckayi* (Schimp.) Broth., leaves less strongly falcate-secund, broadly oblong, less acuminate.

H. dilatatum (Wils.) Loeske. Plants resembling in gross appearance small

forms of *Eurhynchium rusciforme*. Easily distinguished from all our other mosses having a similar habitat by its *broadly oval to almost circular, short-acuminate to apiculate leaves*, slightly denticulate at apex, with costa short and double, rarely single and longer. The leaf cells are linear-flexuose, 10-15:1; alar cells enlarged, subquadrate to elongated

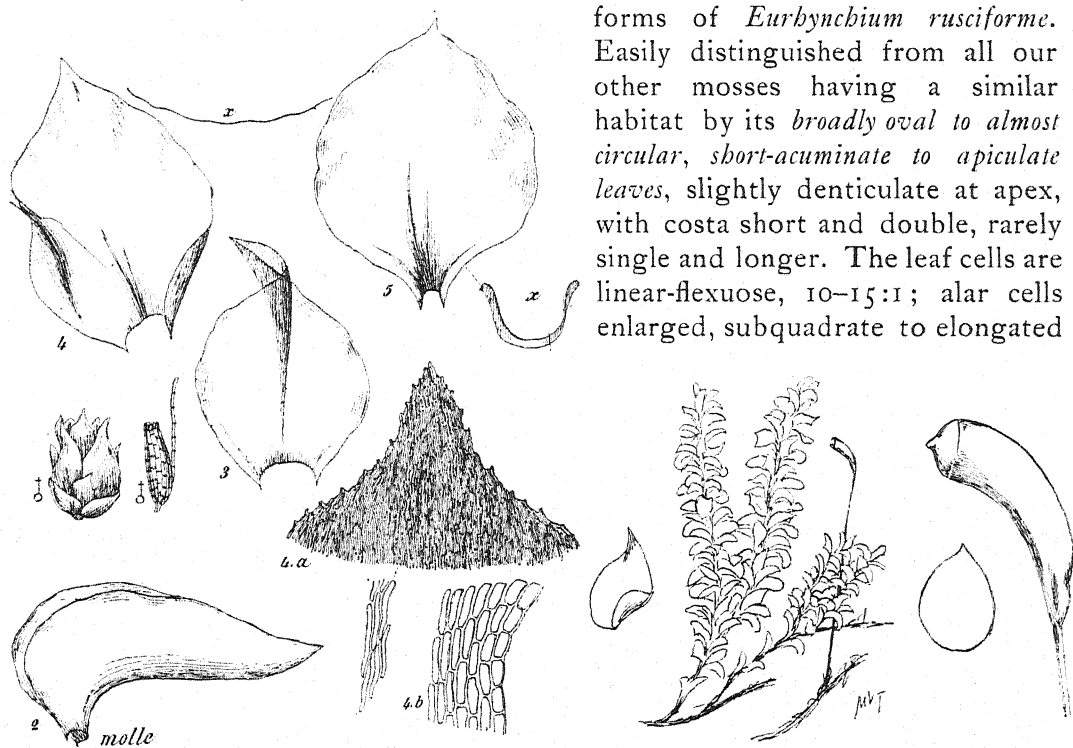


FIGURE 180. *Hygrohypnum dilatatum* (Figs. 1-5 from Bry. Eur. 4b, alar cells). In the other figures is represented a plant $\times 3$, and leaves and capsule $\times 10$.

hexagonal, frequently colored; spores in summer. Common in mountain brooks on stones. This is the *Hypnum molle* of the Bryologia Europea and many other authors. The true *Hypnum molle* Dicks. probably does not occur in our range although it is found in the western mountains. Its leaves are narrower proportionately, widely ovate, short-acuminate and obtuse; leaf cells 5-8:1.

H. palustre (Huds.) Loeske. Exceedingly variable, and very rare in our range, more frequent in the Rockies and westward, common in Europe. Slender to robust, dark to yellowish green, forming rather loose mats on stones in and near streams; branches, in some forms, hooked or curved at the ends; leaves sometimes closely imbricated all around the stems rendering them julaceous and shining, sometimes more or less falcate-secund, concave with margins incurved, especially toward the apex, ovate-oblong, variable toward apex, acuminate and obtuse or acute, or rounded and obtuse or apiculate, never with a long slender acumination, entire throughout, 1-1.5mm long; costa usually single and forking, reaching the middle of leaf or beyond, but in some cases it may be short, faint and double; median leaf cells 5-10:1; quadrate alar cells few, plainly enlarged but comparatively rather small and opaque as a rule. Much of the material found in N. American herbaria consists of aberrant forms of *H. ochraceum*, distinguished at once by the outer layer of stem cells if other characters fail.

H. Clósteri (Aust.) (*Amblystegium Holzingeri* R. & C.). Plants very slender; stems denuded of leaves below; stem leaves oblong-ovate, *costate, scarcely acuminate, obtuse, not secund* or scarcely so; branch leaves of the *almost flagelliform branches* broadly ovate-obtuse, flat and often scarcely costate. It might be taken for a minute form of *molle* but for the strong costa of the stem leaves and *absolutely entire leaf margins*. Mountain brooks, probably throughout our range; rare.

H. montanum (Wils.) Broth. is an alpine or subalpine moss found in the mountains of New England and in Canada and Newfoundland. It is a small species growing in wide mats on wet rocks; central strand lacking; leaves falcate-secund to subsquarrose, broadly ovate-lanceolate, acuminate and acute, *serrulate nearly or quite to base*, margin reflexed below; costa short and double or lacking; leaf cells 6-10:1, shorter at base and apex. I find some leaf-like paraphyllia present, though other authors say nothing about them. I consider this one of the most distinct species of the genus, in spite of the fact that Sullivant stated that it is close to *palustre*.

SCORPIDIUM (Schimp.) Limpr.

S. scorpioides (L.) Limpr. Aquatic, *very robust*, one of the largest of mosses, *reaching 3 dm* in length, divisions little branched or with short branches; forming large soft masses of a dark or brownish green, often reddish, sometimes nearly black; *branches and branchlets curved at ends, very turgid by reason of the*

very concave imbricated leaves; leaves more or less *falcate-secund*; stem leaves 2-4 x 1.4-2 mm, not *plicate* but *rugose* when dry, broadly ovate-oblong, narrowed to the insertion, not *decurent*, abruptly narrowed to an obtuse or apiculate apex, entire (occasionally acute or acuminate and slightly denticulate at apex); costa faint, short and double, or even lacking; median leaf cells narrowly linear-flexuose, 15:1, thick-walled, a few at the insertion shorter and wider, a few at extreme angles somewhat inflated and thinner-walled: dioicous: seta very long, 4-6 cm; capsule *strongly curved from an erect neck*, *plicate* and contracted under the mouth when dry; peristome perfect; annulus very large; spores in late summer. Bogs throughout our range, but not common. Distinguished from *Calliergon* by its aquatic habitat, great size and dark color. *Drepanocladus Wilsoni* approaches it in size, but in *D. Wilsoni* the leaves are costate and slenderly acuminate.

HYPNUM L.

Plants usually more or less regularly pinnately branched, often plumose in appearance. Leaves *falcate-secund* and in most species apparently arranged in two rows, giving the stems a *somewhat flattened appearance on one side* (usually the upper) and a *bristly appearance on the opposite side*. Leaves in most cases long-acuminate; costa short and double, or lacking entirely; leaf cells linear-flexuose, 4-20:1, shorter at base; alar cells more or less plainly differentiated, often enlarged, hyaline or colored. Paraphyllia present in all our species, few or found only in axils of branches in some cases. Central strand in stem usually present, but few celled. Capsules subcylindric, more or less curved and cernuous; peristome perfect (excl. *H. tenuirostris*).

Most of the mosses of this genus have a very similar appearance, due to the leaf arrangement described above and the regularly pinnate and two-ranked branching. Exceptions are *Haldanianum* with its irregular branching; leaves equally spreading, not *falcate*. *H. patientiae*, *H. pratense* and forms of *H. cupressiforme* are irregularly pinnate. The species grow on all sorts of habitats but many have a marked preference for decaying wood. *H. imponens* is one of our most common and typical species. Its capsule, however, is more nearly straight and erect than in most species.

KEY

1. Alar cells inflated, pellucid, hyaline or colored. (Forms of *cupressiforme* may be sought here). 2.
- Alar cells scarcely inflated, often small and quadrate, (*fertile*, and *curvifolium* may be sought here). 11.
2. Leaves not *falcate* or *secund* 3.
- Leaves *secund*, usually strongly *falcate-secund* 4.
3. Leaves ovate, short-acuminate; inflated alar cells numerous, forming distinct auricles *Haldanianum*.

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- Leaves ovate-lanceolate, long and slenderly acuminate, not auricled; differentiated alar cells few, not much enlarged *pratense*.
4. Leaves entire or serrulate above only 5.
Leaves strongly serrate above; inflated alar cells very conspicuous 9.
5. Inflated alar cells numerous and conspicuous; capsules plicate when dry . . . *Patientia*.
Inflated alar cells rather few 6.
6. Not regularly pinnate; habit of *Plagiothecium* *pratense*.
Regularly pinnate 7.
7. Stems reddish; capsules cylindric, little curved and suberect *imponens*.
Stems not noticeably reddish; capsules curved and inclined 8.
8. Plants small, yellowish; capsules not plicate *fertile*.
Plants larger, dark green; capsules plicate when dry *curvifolium*.
9. Leaves in two rows, appearing more or less complanate; capsules curved and inclined; cilia of peristome one or two 10.
Leaves not appearing complanate; capsules erect and symmetric or nearly so; cilia none or rudimentary *tenuirostris*.
10. Plants larger, bright glossy yellow-green; urn of capsule twice the length of operculum *recurvans*.
Plants smaller, usually darker green, growing at high altitudes; urn about the length of operculum *delicatulum*.



FIGURE 181. Leaves, leaf structure and paraphyllia of *Hypnum Crista-castrensis* (From Bry. Eur.)

11. Plants very large and beautifully plumosely branched; leaves plicate *Crista-castrensis*.
 Plants smaller, less plumose; leaves not plicate 12.
12. Stems reddish; quadrate alar cells not very numerous *imponens*.
 Stems not noticeably reddish; quadrate alar cells numerous 13.
13. Leaves cordate at base *molluscum*.
 Leaves not cordate at base 14.
14. Leaves entire or serrulate above *cupressiforme*.
 Leaves serrate above, serrulate nearly or quite to base 15.
15. Capsules 2.5-3^{mm} long, curved and somewhat contracted below the mouth when dry *reptile*.
 Capsules 1-1.5^{mm} long, symmetric and not contracted below the mouth; plants of high altitudes only *pallescent*.

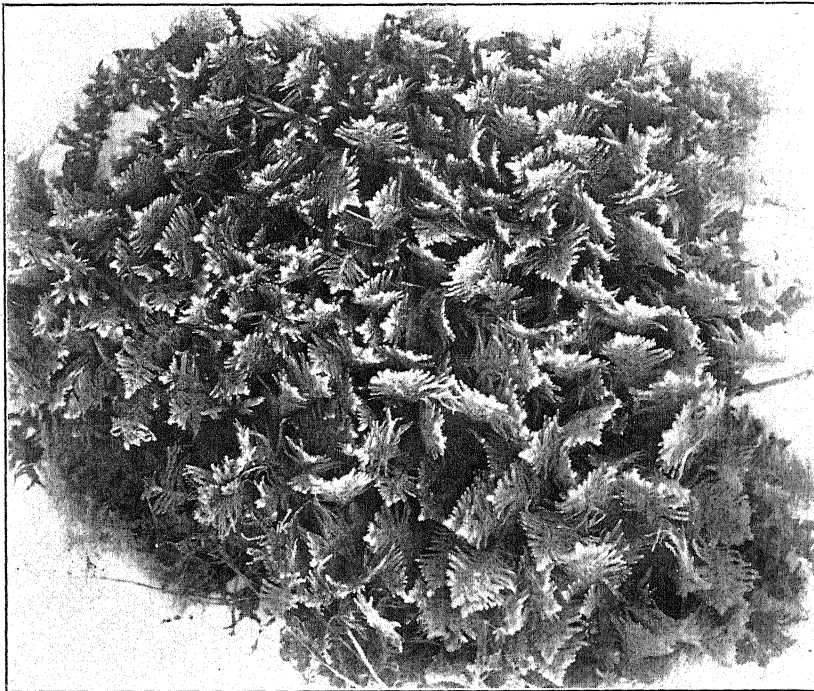


FIGURE 182. *Hypnum Crista-castrensis* (slightly reduced)

SUBGENUS PTILIUM

H. Crista-castrensis L. Plants robust, rigid and *plume-like*; *bright yellow-green above*, darker and brownish below; recognizable at once by the strikingly regular and plumose branching, *the branches about equal in length, except at the triangular end of frond*; *paraphyllia numerous*; *leaves plicate*; stem leaves crowded, thin, shaped as figured, 2.5-2.7^{mm} long, entire at base, *sharply serrulate above*; median leaf cells linear-vermicular, 10.20:1; basal shorter; alar broader and clear,

apex when dry, giving the plants a soft feathery appearance; margins plane and strongly serrate, especially at base, decurrent; costa short and double or lacking; leaf cells 8-15:1, the projecting corners making the leaf somewhat rough as in *Bryhnia*; basal cells broader; alar cells irregularly quadrate-hexagonal, not much enlarged, hyaline or colored, chlorophyllose in young leaves; branch leaves much smaller and narrower; paraphyllia few, at base of branches: dioicous; capsule short, horizontal, curved; operculum long and narrowly acute; spores in summer, infrequent. The L. & J. Manual says, "Mostly in mountain regions," but I find it rare in the mountains of New England and common in the vicinity of New York City. Probably common throughout the southern part of our range. Hardly any of our American material is identical with the common European *molluscum*. It is much less closely pinnate, branches not hooked at the end, with leaves more distant and less falcate. It is often a dark olive-green and is probably near var. *fastigiatum* Bosw.

SUBGENUS STEREODON

H. imponens Hedw. Forming rather thin but densely interwoven mats of a darker green than in *molluscum*; stems reddish-brown, prostrate, rather regularly pinnately branching, but rarely completely pinnate to the end; paraphyllia numerous, broad, often ciliate; stem leaves scarcely decurrent, broadly ovate at base and gradually lanceolate-acuminate above, $2 \times 0.6\text{mm}$, serrulate below, serrate above, with margins usually narrowly recurved below; costa short and double or lacking; median leaf cells linear-vermicular, reaching 10:1, broader at base and colored, often a bright brownish orange; alar cells subquadrate, a few at the extreme angles slightly inflated, clear but colored, all forming small but distinct auricles of a rich orange-brown: dioicous; perichaetial leaves plicate; capsules cylindric, nearly erect, slightly curved; spores in

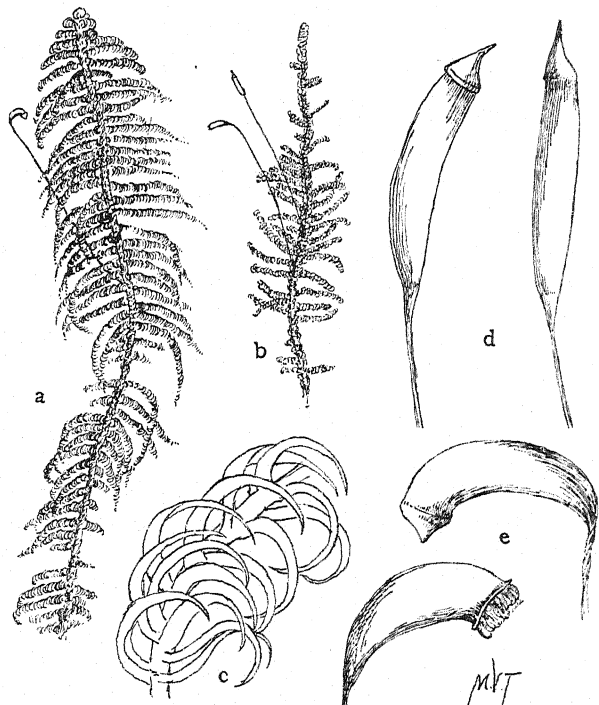


FIGURE 184. a. *Hypnum Crista-castrensis* $\times 1$. c. Branch $\times 10$. e. Capsules $\times 10$. b. *H. imponens* $\times 1$. d. Capsules of same $\times 10$.

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autumn or early winter. One of our commonest Hypnum, growing almost exclusively on rotten wood with us, abundant from Canada to Florida in moist shady places. Often confused with the next, with forms of which it appears to

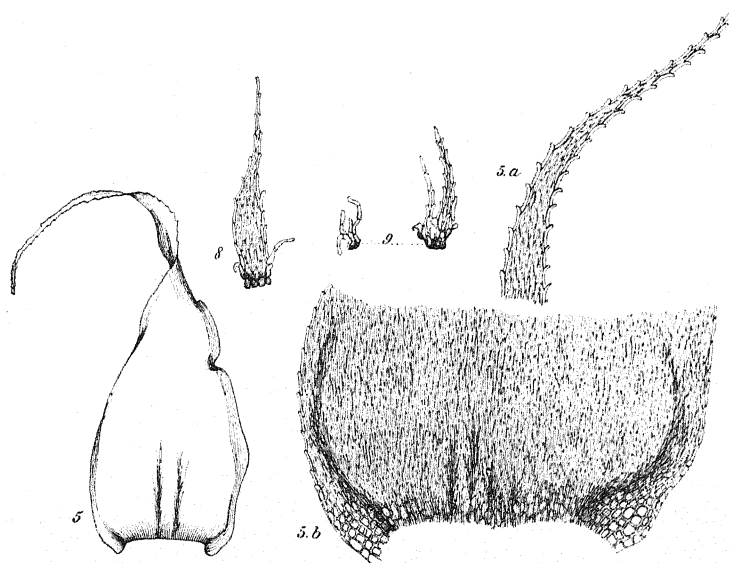


FIGURE 185. *Hypnum imponens*. Leaf, leaf structure and paraphyllia (From Bry. Eur.).
See also Figs. 184 and 186.

intergrade, but the area of auricular cells is much smaller in this species and the extreme alar cells more inflated, this taken with the italicised characters makes ordinary forms easy to distinguish.

H. cupressifforme L. Closely related to the last but typically easily distinguished; very variable, especially in size, and in some varieties likely to be confused. *Paraphyllia* fewer and narrower; stems greenish, less regularly pinnate, less rigid and stouter in appearance; stem leaves entire, or serrulate above only, narrower, slightly decurrent, plane at margins or nearly so, area of subquadrate alar cells much larger, granular and as a rule not distinct as figured unless cleared, little inflated at extreme angles, but a few cells are larger and clearer, leaf bases usually not colored except at the angles: dioicous; perichætal leaves not plicate; spores in late autumn or early winter. Growing on stones, bases of trees, earth, etc. Common in Europe, but local with us. It seems not rare along the coast from Massachusetts to New York. It or its varieties occur from Newfoundland to Minnesota and southwards to the limit of our range at least. It is rarely sent for determination and the specimens are mostly depauperate and sterile. Hardly any two specimens are alike, there being great differences in size and differences in regularity of branching and in color, and in length, curvature and acumination of the leaves. We have

Var. *filiforme* Brid. with very long slender parallel branches forming thin smooth patches and having very small leaves, "very regularly and neatly imbricated in two rows, falcate-secund or hamate, usually denticulate." Some of the material referred to this variety is

Var. *resupinatum* (Wils.) Schimp. Branches filiform, erect or ascending; leaves straight or only slightly curved, narrow, oblong-lanceolate; alar cells sometimes large: capsule erect and symmetric or nearly so; operculum rostrate.

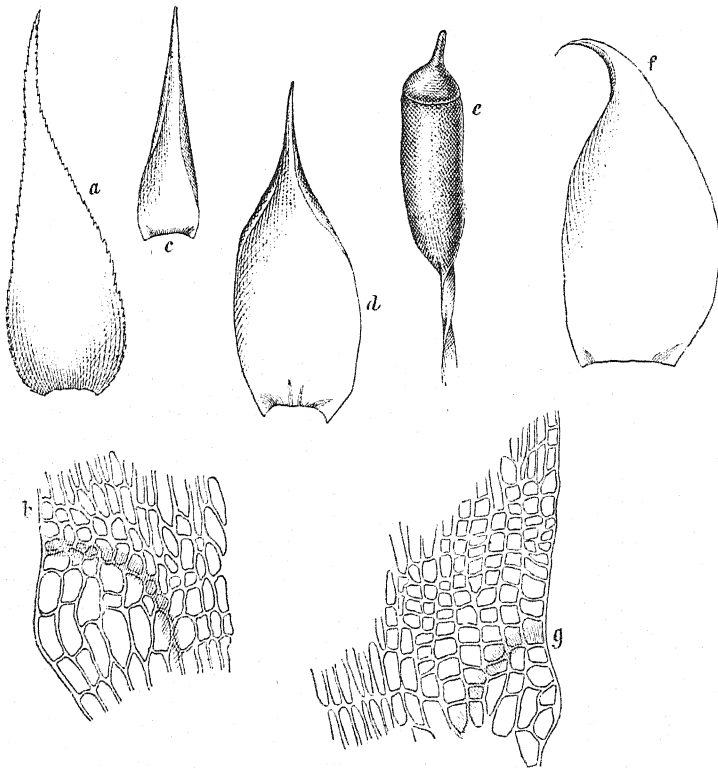


FIGURE 186. *Hypnum cupressiforme* (after Limpricht). *a*. Stem leaf $\times 22$ and *b*, alar cells $\times 150$ of var. *ericetorum*. The alar cells are typical of *H. imponens*. *d*. Stem leaves $\times 22$ of var. *subjulaceum*. *f*. Stem leaf $\times 22$, *g*, alar cells $\times 150$, and *e*, capsule $\times 15$, of var. *elatum*. These alar cells are typical of the species.

Var. *ericetorum* B. & S. Approaching very closely to *H. imponens* in general appearance and structure of alar cells. Of this I have seen no American forms that were typical of the variety but only those approaching it.

Var. *ubjulaceum* Molendo. A form usually growing on cold barren substrata. Stems and branches subjulaceous, leaves closely imbricated, broadly ovate, abruptly narrowed to a slender acumination, less curved than in the species.

H. molluscum and *H. reptile* are the only two of our Hypnums that have an equal area of subquadrate alar cells; the cordate leaf base of the former and the

small size and sharp serration of the leaves of the latter will prevent confusion. *H. curvifolium* often appears much like forms of *cupressiforme*, but its few subquadrate alar cells and its subcordate leaf base are good distinctions. Forms of the species resemble *Amblystegiella adnata*. For distinctions see that species.

H. curvifolium Hedw. Resembles *H. imponens* in general appearance, but is rather larger and *more widely complanate-secund*. Branching typically regularly pinnate but often irregularly pinnate, branches unequal; leaves *very regularly and evenly falcate-secund in two rows, giving a characteristic plaited appearance to the plants*; stem leaves entire or serrulate above, concave with plane margins, *oblong-ovate to elongated triangular-ovate*, long-acuminate with acumen channeled, not so abruptly

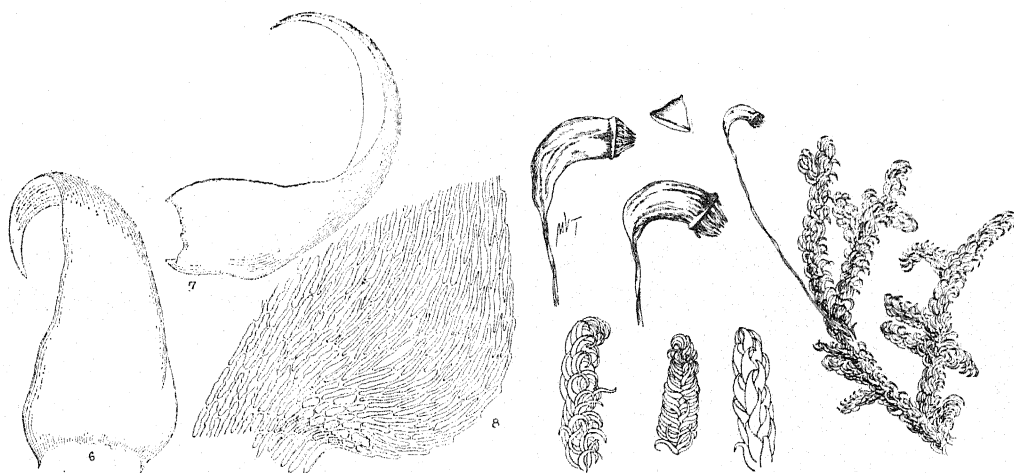


FIGURE 187. *Hypnum curvifolium*. 6, 7, and 8 from Sulliv. "Icones."

In the others, plant $\times 2$, tips of branches $\times 4$, and capsules $\times 4$.

narrowed as in the two preceding species; base abruptly narrowed to the insertion, *subcordate and slightly decurrent, the decurrent cells enlarged, thin-walled and hyaline*; a few alar cells subquadrate, the median linear-vermicular, very narrow, basal more or less colored; costa entirely lacking or short and double: dioicous; perichæatial leaves *plicate*; capsules *strongly plicate* when dry and empty; spores in spring. Growing in large mats on various substrata around brooks in cool wet places. Common in elevated regions. There is a great variation in robustness and in width and serration of leaves, but in fruit the plicate capsules furnish a character that will at once distinguish it from all closely related species except the next. When sterile the basal angles of the leaves are not likely to be confused with any other species.

H. Patiéntiae Lindb. Often confused with *H. curvifolium* but usually larger, *more yellowish-green, more erect and irregularly branched*. Stem leaves strongly falcate-secund and not so strongly complanate and lacking the plaited appear-

ance, entire except at extreme apex, $2-2\frac{1}{2}$ mm long, narrowed at insertion but not cordate, with very conspicuous decurrent auricles composed of inflated byaline thin-walled cells: dioicous; perichæatial leaves plicate; capsules plicate as in *curvifolium*, sparingly produced; spores in spring. Common on the ground in swamps and wet places. Referred to in the L. & J. Manual in the note under *curvifolium*. This species is almost as variable as *cupressiforme*, varying from pale lax prostrate forms with the habit of *pratense*, to robust, suberect, little branched forms with the appearance of a *Drepanocladus*. Commonly yellowish green and often very light colored, but I have collected specimens growing in water that were almost black. The leaves may be broad and short with almost the outline of a *Hygrohypnum*, almost symmetric and nearly flat, or in other forms much narrower, concave, long-acuminate and somewhat plicate. The basal angles may be almost as rounded as in *curvifolium* or may have the outline of *pratense*. But in all these forms are found the large hyaline inflated alar cells and plicate capsules. Sterile forms approach *pratense* so closely in some cases as to render determination uncertain, but these forms are infrequent.

Var. *elatum* Schimp. is the extreme of the erect robust plant with the *Drepanocladus* habit and narrow slenderly acuminate leaves.

Var. *demissum* Schimp. is the lax yellowish creeping form with the habit of *pratense*.

H. pratense Koch. Bright green, complanate-flattened with a *Neckera* or *Plagiothecium* habit; leaves slightly concave, often nearly flat, frequently serrulate at apex, less falcate and less secund than in *Patientiæ*; enlarged alar cells few, less inflated and less distinctly marked off, more often colored: dioicous; perichæatial leaves plicate; capsules not plicate, rarely produced; spores in spring. A moss of swamps, not abundant but apparently widely spread.

H. fertile Sendt. Resembles small forms of *H. imponens*, but is of a lighter, more yellowish green. Plants regularly and evenly pinnate; stem leaves not plicate or decurrent but subclasping at base, strongly secund, falcate to subcircinate, 2×0.5 mm, oblong-lanceolate, very long- and narrowly acuminate, narrowed at insertion; margins slightly reflexed near the base, serrulate at apex, costa short and

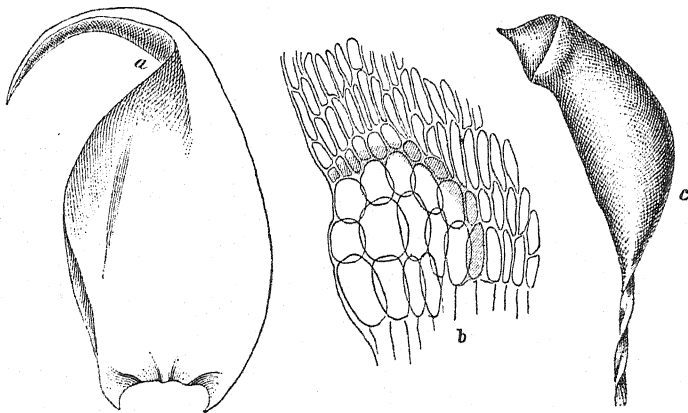


FIGURE 188 *Hypnum Patientiæ* (after Limpricht)

double or lacking; median leaf cells linear-flexuose, reaching 15:1; *differentiated alar cells very few, those at the extreme angles just below where the narrowing begins are thin-walled, inflated and hyaline*, about as many cells immediately bordering these are small subquadrate and subopaque: monoicous; perichætal leaves plicate; capsules curved and somewhat contracted under the mouth when dry;

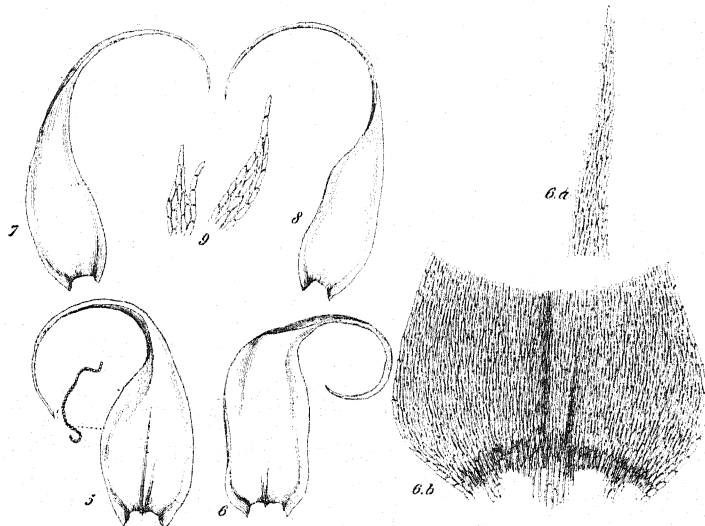


FIGURE 189. *Hypnum fertile* (From Bry. Eur.). Alar cells not well figured

to be confused because of the difference in size and the much broader leaves of *curvifolium*.

H. réptile Mx. Plants small, dark green, more or less regularly pinnate but so closely interwoven that the pinnate branching is not as conspicuous as in the preceding species, approaching *Amblystegiella adnata* in appearance as the branches appear almost *julaceous* from the upper side, but the bristly points of the falcate-secund leaves are easily seen on the under side in most cases; stem leaves long and slenderly lanceolate-acuminate from an ovate base, slightly and narrowly decurrent, about 1×0.5 mm; margins *revolute and serrulate below*, strongly serrate above; median cells linear-rhomboidal to linear-flexuose, 6-10:1, quadrate alar cells *very numerous and subopaque* much as in *cupressiforme*, not hyaline or inflated, all basal cells shorter and more or less colored: monoicous; perichætal leaves plicate; capsules about 2.5 mm long, subcylindric and somewhat inclined, shrinking most at the under side of the mouth so that the operculum points almost at right angles to the lower portion of the capsule; spores in midsummer. Common on the bases of trees, stones and decaying wood in shaded places in elevated regions, less frequent at low levels. At about 2,500 feet its place is more or less taken by the next. The abundant midsummer fruiting of this species makes it easy to

spores in early summer. On decaying wood in cool, elevated wooded regions, not common. A beautiful little species about the size of *H. réptile* from which it is easily distinguished by its color and its alar cells. From *imponens* it is distinguished by these and by its more curved capsules. Its alar cells are more like those of *curvifolium* than any other species, but the two are not likely

recognize, although the leaves vary a good deal in width and slenderness of acumen. There are forms which intergrade with the next but they are not abundant. Depauperate lowland forms are confused with *Amblystegiella adnata*, but *H. reptile* has much more slenderly acuminate leaves, always serrate, and a plainly beaked operculum.

H. palléscens (Hedw.) B. & S. is an alpine development of the preceding. It grows on the bark of trees at high altitudes, and is less regularly pinnate; leaves *more slenderly acuminate*, less serrate with a *smaller area of quadrate alar cells* and *capsules about ½ the length of those of reptile, nearly symmetric and erect, not*

*shrinking under the mouth when dry; spores in late summer. This can usually be distinguished at sight by the thinner mats of a more silky appearance, due to the slender, less closely imbricated leaves, by the branches often curved at the ends and by the short symmetric capsules. According to Mrs. Britton, *Hypnum Jamesii* (Sulliv.) L. & J. is a synonym of this species.*

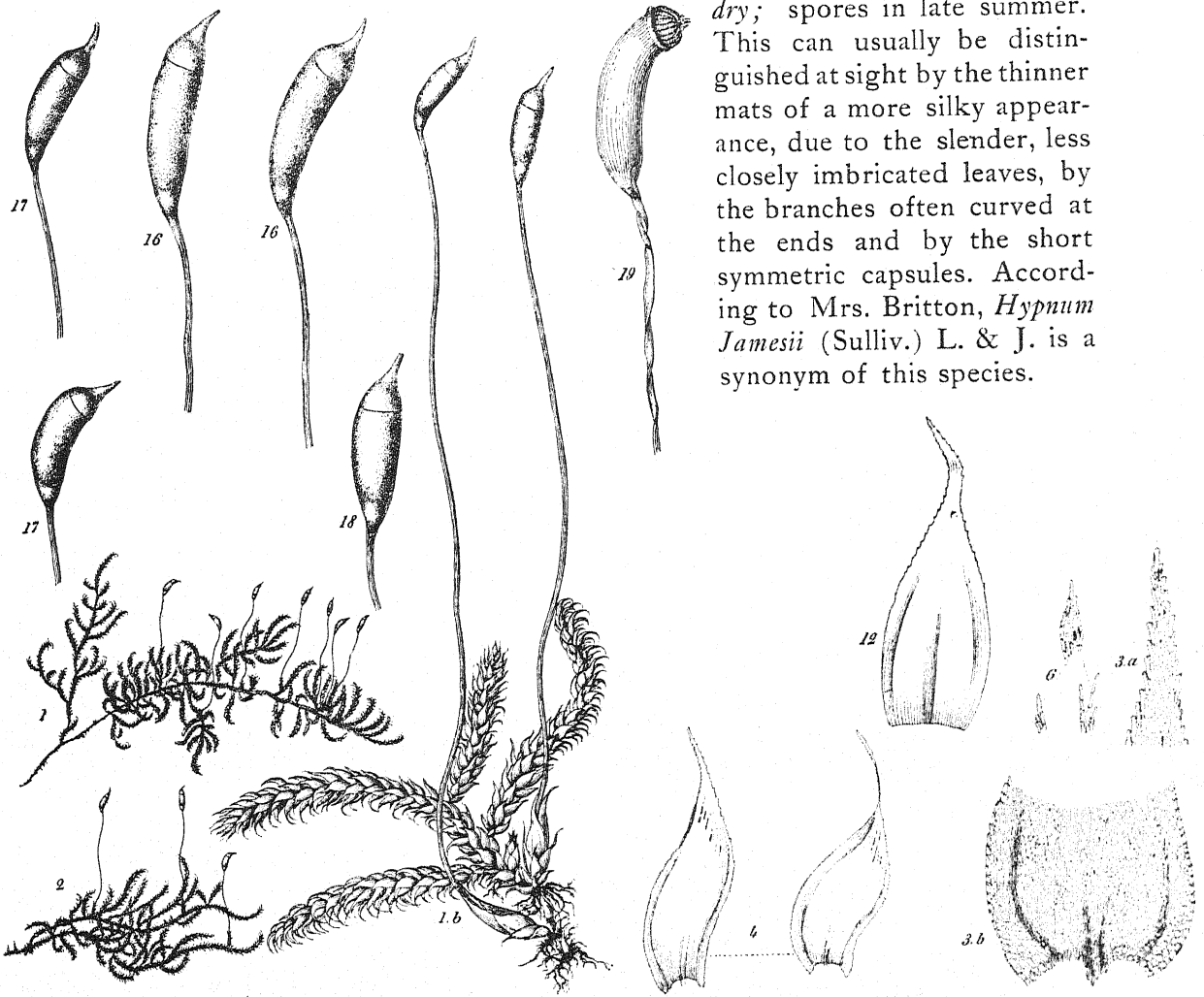


FIGURE 190. *Hypnum reptile* (From Bry. Eur.)

SUBGENUS HETEROPHYLLIUM

H. Haldanianum Grev. Plants in loose wide mats usually dark or brownish green with the habit of *Brachythecium oxycladon*, irregularly branching;

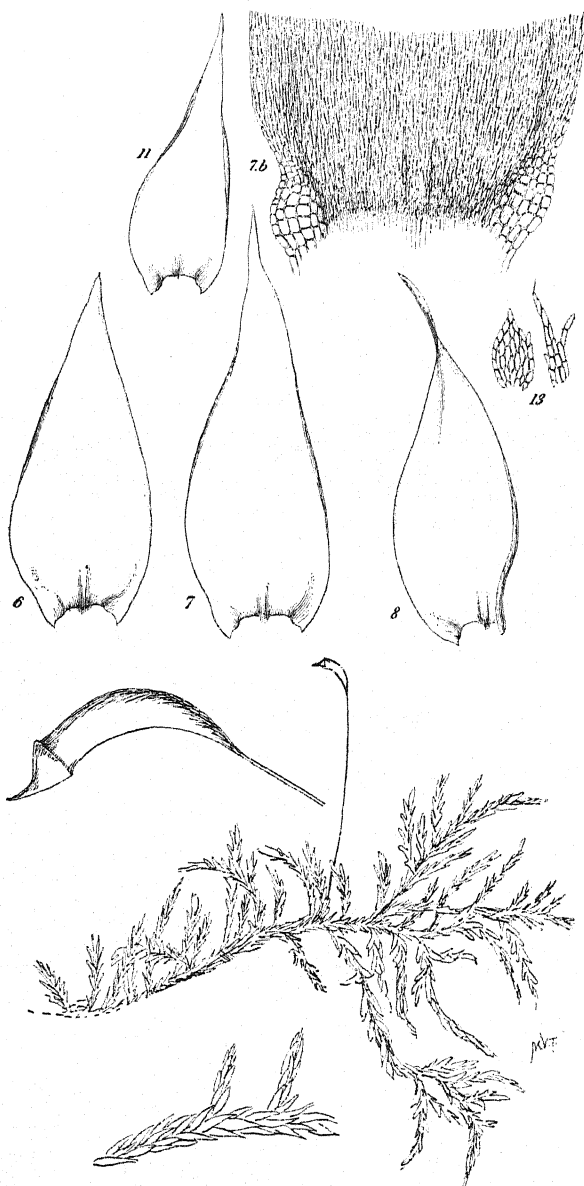


FIGURE 191. *Hypnum Haldanianum* (Leaves and leaf structure from Bry. Eur.)

not falcate or secund, loosely and nearly evenly imbricate; paraphyllia large and numerous; stem leaves not decurrent, broadly ovate-lanceolate to oblong-ovate, rather rapidly narrowed to a short but slender acumen, very concave; margins plane and entire; median cells linear-flexuose, 12-18:1; area of enlarged and inflated alar cells large and forming distinct auricles bordered above by a line of smaller subopaque quadrate cells: monocious; capsules long cylindric, with lid 2.5-3mm long, suberect or inclined, somewhat curved; lid short-beaked; spores in late fall and winter. Common on decayed wood in cool shaded places, more abundant in elevated regions. Its straight leaves make it look more like a *Brachythecium* than any of the other species, but otherwise it seems clearly to belong here.

SUBGENUS
PSEUDO-RAPHIDOSTEGIUM

H. recurvans (Mx.) Schwaegr. Plants yellowish green, very glossy, rather irregularly branched; leaves strongly falcate-sekund except in slender or depauperate forms; stem leaves ovate-lanceolate, slenderly long-acuminate, not decurrent, somewhat concave; margins usually somewhat reflexed

below, *very sharply serrate above*; costa lacking or short and double; median cells linear-flexuose, basal broader and shorter and usually somewhat colored; *at the extreme angles are four to eight very much enlarged and inflated hyaline or colored cells*, three or four above these along the margin smaller and subquadrate: dioicous; perichæatial leaves strongly spinose-dentate above, not plicate; capsule oblong-ovoid, curved and oblique, *lid long-beaked*, about $\frac{1}{2}$ length of urn; *annulus present*; spores in November and December. Common on decayed wood and soil at base of trees in moist shaded places; more abundant in elevated regions, varying a great deal in general habit and robustness.

This species and the two following have usually been put in *Rapidostegium* but Brotherus places them with the preceding species and I am inclined to agree with him. The strongly beaked opercula, inflated alar cells and spinose-serrate leaves distinguish these three from all the rest of this genus.

H. laxepatulum L. & J. (*H. delicatulum* (James) in key). At high elevations *recurvans* grades into this species, a smaller, darker, less glossy moss, growing in thinner mats, having the leaves less constantly falcate-secund, seta shorter, operculum as long as the shorter urn, annulus lacking.

Mrs. Britton states that cilia are present as in *recurvans* even in the type specimen. Intermediate and puzzling forms are not rare. The markings of peristome teeth and the structure of alar cells is practically the same in both species.

H. tenuirostris (B. & S.) (*H. cylindricarpum*. L & J. Manual) is a rather rare moss of cool or elevated regions extending north to Connecticut, central New York and northern Pennsylvania; more abundant southwards, often confused with *laxepatulum* when sterile, but the leaves, though falcate-secund and serrate in much the same way, are not at all complanate as in the preceding two species and are more narrowly lanceolate; the margins are strongly reflexed to base of acumen, and above the inflated alar cells are several small subopaque cells which are *quadrate, usually some transversely elongated* as in *Amblystegium serpens*. Leaves of *laxepatulum* and *tenuirostris* can be found that are very much alike, but a great majority of the leaves of the latter have a conspicuously large number of these subopaque cells, some of which are broader than long. The stems are also very brittle and it is difficult to get leaves off so as to show the alar cells satisfactorily. In fruit there can be no confusion for the capsules are erect and symmetric; annulus lacking and cilia of peristome rudimentary or lacking.

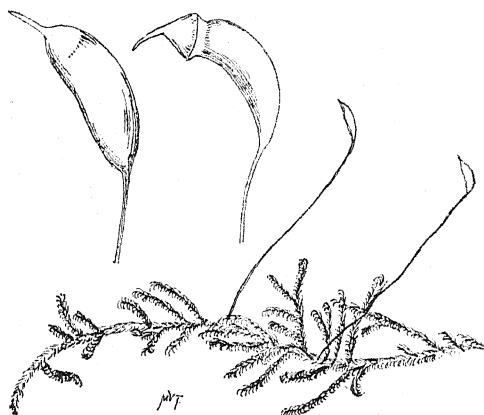


FIGURE 192. *Hypnum recurvans*. (For markings on teeth see Plate 81.)



PLATE LXXXI. *Hypnum taxepatiuum* (From Sulliv. "Icones.")

RAPHDOSTEGIUM (B. & S.) De Not.

Mostly slender mosses with irregular branching; paraphyllia lacking; leaves symmetric and equally spreading or somewhat secund, narrowed to the insertion, *not decurrent*, concave, not plicate; *margins entire or nearly so (except in Novæ-Cesareæ)*, strongly reflexed in most cases; costa lacking or short and double; leaf cells linear-flexuose, shorter and broader at base; *at basal angles 3-8 large inflated pellucid, hyaline or colored cells*, very conspicuous: capsules small, oblong-ovoid, more or less unsymmetric and inclined (excl. *R. adnatum*); lid beaked, peristome usually perfect. Cell walls of outer layer of capsule strongly colenchymatous (i.e. strongly nodulose at points of intersection), in all our species except *Novæ-Cesareæ*. This genus differs from *Hypnum*, subgenus *Pseudo-Raphidostegium*, in the lack of paraphyllia, less falcate and scarcely secund or serrate leaves, and in the characteristic cell walls of the capsules. All southern, reaching our range as a northern limit. The leaves described in this genus are from the middle of the branches.

KEY

1. Plants growing on trees, of *Pylaisia* habit; capsules erect and symmetric or nearly so *adnatum*.
Plants growing on rocks and stones, capsules inclined to horizontal 2.
2. Leaves suborbicular, serrate *Novæ-Cesareæ*.
Leaves oblong-ovate to oblong-lanceolate; entire or slightly serrulate 3.
3. Plants large; leaves 2-2.5^{mm} long *Marylandicum*.
Plants smaller; leaves 1.5^{mm} long or less *Carolinianum*.

R. adnatum (Mx.) B. & S. (*Hypnum microcarpum* L. & J. Manual). Plants in rather small thin mats, green to golden green; stems prostrate; branches rather short, suberect, *often curved at ends*; leaves rather closely imbricate when dry, *narrowly oblong-lanceolate, short-acuminate*; margins broadly reflexed, entire or nearly so; median cells linear-fusiform, somewhat flexuose; just above the inflated alar cells is a group of quadrate to subrectangular cells, little or not at all inflated: monoicous; capsules small, oblong-ovoid, erect and symmetric or nearly so; annulus lacking; peristome teeth with a much heavier median line than in most cases; cilia single and short; spores summer to autumn. Common in the South and extending northward to northern Pennsylvania, New Jersey and Rhode Island. Distinguished by its habitat on the bark of living trees and its *Pylaisia* habit and erect capsules.

I can find no plants of this genus growing on trees and having curved strongly inclined capsules, neither can I find plants growing on stones that have erect and symmetric capsules. I am convinced that the form with inclined and unsymmetric capsules described by Sullivant as var. *anisocarpon* (*H. admixtum*

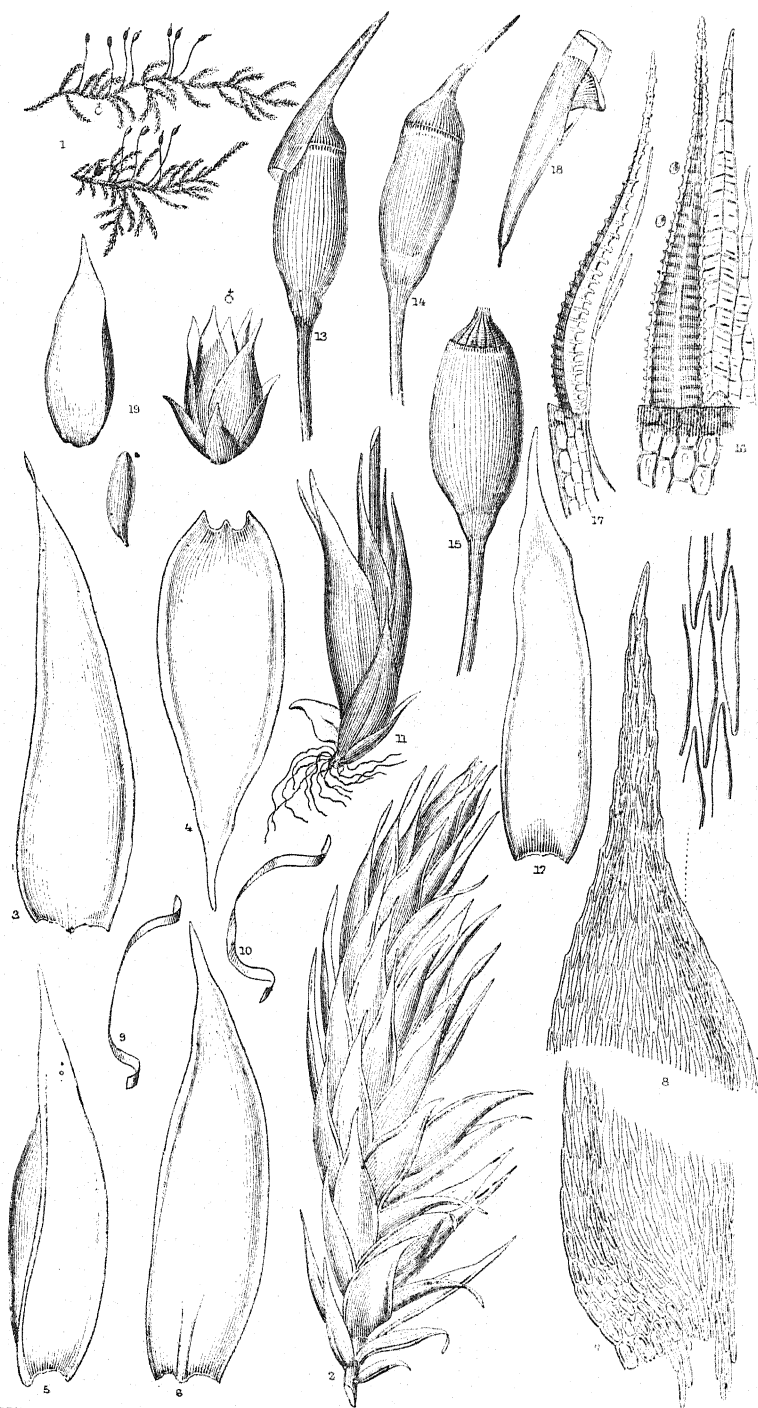


PLATE LXXXII. *Raphidostegium adnatum* (From Sulliv. "Icones"). The inflated alar cells are not correctly represented and the fine lines on the peristome should be transverse instead of longitudinal.

Sulliv.) belongs rather to *R. Carolinianum*, from which I can see little to separate it except characters due wholly or in part to its habitat on stones in woods instead of wet rocks in or near streams. Our plant certainly is not the same as Wright's from Cuba, specimens of which I have had the privilege of seeing through the courtesy of Mrs. Britton. The leaf cells in Wright's plant are narrower and the capsule walls are not collenchymatous.

R. Carolinianum (C. M.) J. & S. Larger than the last, darker green, dirty green below, growing on wet rocks; branches less erect, often little or not at all curved; *leaves broader, acute rather than acuminate*, more often serrulate at apex, less secund and with margin more broadly reflexed all the way around; capsules *curved and inclined, constricted under the mouth when dry*; cilia one or two: spores in summer. Common in the southern states, extending north to Canada but apparently rare north of New Jersey. This species is very close to the European *R. demissum* (Wils.) De Not., but Mrs. Britton thinks the two are distinct, as she has been unable to find on American plants the stomata with four guard cells which, according to Limpricht, are characteristic of *demissum*. She also records other slight differences.

Var. *admixtum* (Sulliv.) also grows on stones but in drier situations, usually in moist woods. The plants are usually lighter green, with branches shorter and more erect and more curved at the ends when dry; leaves more closely imbricated when dry, smaller and usually narrower. In dry situations the plants resemble *adnatum* in appearance but always have cernuous curved capsules, at the other extreme it grades imperceptibly into *Carolinianum*. Massachusetts to Florida, apparently more abundant near the coast.

R. Marylandicum (C. M.) J. & S. *Much larger than the preceding*, dark green, growing on wet rocks in cool shaded places, especially mountain ravines, somewhat resembling *Brachythecium plumosum* in appearance and habit, but rather more prostrate; stems reaching 1 dm in length, but usually shorter; leaves often somewhat secund, especially at ends of stem and branches; *leaves oblong-ovate, acute to short-acuminate, about 2.5 x 1 mm*, very concave, *margins less reflexed* and leaf cells *more narrowly linear and longer* than in the preceding; basal shorter and strongly colored; *inflated alar cells very large*; capsules scarcely larger than in the last, very small for the size of the gametophyte; strongly contracted under the mouth when dry. Common in the mountains from Virginia southward, extending north to the White Mountains. Easily confused with *Hygrohypnum eugyrium* when sterile.

R. Növæ-Cæsarèæ (Aust.) R. & C. Plants small, yellowish green; stems prostrate, slender, little branched; leaves often somewhat secund, suborbicular, acuminate, serrate at apex; very concave, margins somewhat reflexed below; median cells linear-flexuose; alar inflated; but less strongly so than in our other species; dioicous; capsules collected but once, horizontal; operculum beaked;

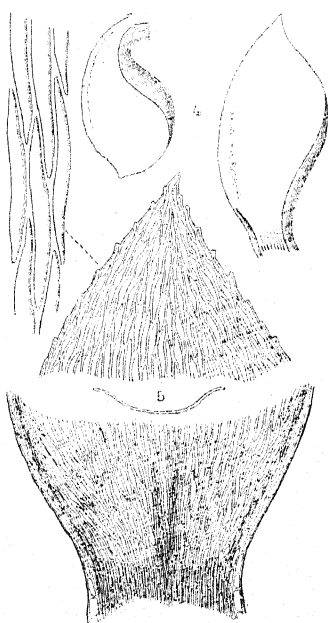


FIGURE 193. *Raphidostegium*
Novæ-Cesareæ. (From Sulliv.
"Icones.")

capsule walls not collenchymatous. On wet rocks in cool ravines. Pennsylvania and New Jersey and southward in the mountains; rare and not abundant in regions where it occurs.

PLAGIOTHECIUM B. & S.

Mostly loosely tufted glossy mosses, growing on moist stones and earth, roots of trees and decaying wood, irregularly branching; stems and branches appearing flattened by reason of the complanate leaves (except in *Roeseanum*, *pulchellum* and *striatellum*). The twisting to the sides makes some of the leaves unsymmetrical, (except in the species named above) but otherwise they are symmetrical. Stems and branches often ending in flagella or stolons; paraphyllia lacking. Stem and branch leaves usually much alike, ovate to ovate-lanceolate or oblong-lanceolate, little concave, margins usually plane; differentiated alar cells few (except in *striatellum* and *latebricolor*); median cells long, linear-flexuose to linear-rhomboidal; costa lacking, or short and double, or forking. Capsules oblong-ovoid to cylindric, usually inclined and more or less unsymmetric (except *latebricolor* and *letum*).

P. striatellum, because of squarrose leaves and inflated alar cells, is likely to be sought under *Campylium*. *Hypnum pratense* forms are apt to be sought under *Plagiothecium* because of the complanate leaves. The two subgenera are, by many authors, treated as separate genera, and there are good reasons for so doing, but in a work of this kind conservatism is believed to be most helpful.

KEY

- Mostly very slender plants, light yellowish green to whitish, glossy; leaves little or not at all decurrent; median leaf cells narrowly linear, alar little or not at all differentiated; capsules not plicate (except in *turfaceum*) *Isopterygium*.
Usually larger, darker green; leaves decurrent; leaf cells wider; alar clearly differentiated; capsules often plicate *Euplagiothecium*.

ISOPTERYGIUM MITT.

1. Leaves complanate 2.
Leaves not complanate, entire *pulchellum*.
2. Leaves entire, scarcely a trace of serration on any leaf; cortical cells of stem very large; plants of cold ravines, growing mostly in moist crevices of ledges. *Muellerianum*.
Leaves (some or all) more or less serrate 3.

3. Leaves strongly serrate in the upper half 4.
Leaves serrulate at or near apex only 7.
4. Plants very slender, usually growing on decayed wood or humus, sometimes on soil. 6.
Plants largest of the subgenus, resembling *Euplagiothecium*, growing on earth and stones 5.
5. Plants dark green; leaves distant, apex usually bluntish as in *Eurhynchium hians*. *geophilum*.
Plants lighter green, usually yellowish and glossy; leaves closer, not blunt . . . *deplanatum*.
6. Leaves short-acuminate; capsule not striate; operculum rostrate *Groutii*.
Leaves long and slenderly acuminate; capsules somewhat striate when dry and empty; operculum conic *turfaceum*.
7. Plants light yellowish green; costa very faint or none; growing chiefly in the lowlands from Long Island southwards *micans*.
Plants not yellowish, often dark green; costa evident, often reaching the middle of the leaf; growing in cool ravines and on mountains *elegans*.

EUPLAGIOTHECIUM

1. Leaves not complanate, squarrose-spreading; capsule strongly striate *striatellum*.
Leaves complanate (excl. *Roeseanum*) 2.
2. Plants very slender, with habit and appearance of *Isopterygium*; capsules erect and symmetric; peristomes without cilia *latebricolor*.
Plants more robust, with the habit of *P. denticulatum* 3.
3. Leaves slenderly acuminate; capsules erect and symmetric; peristomes without cilia. *laetum*.
Leaves acute to somewhat acuminate; capsules more or less inclined and unsymmetric; peristome perfect 4.
4. Not complanate or only slightly so *Roeseanum*.
Conspicuously complanate 5.
5. Plants dingy or yellowish green; leaves shrunk when dry; dioicous; operculum rostrate *sylvaticum*.
Plants bright green; monoicous; operculum conic 6.
6. Edges of leaves strongly incurved and clasping the base of the leaf above, Fissidens-fashion. Plants of swamps *Ruthei*.
Leaves not as above or to only a slight degree; plants of all regions. *denticulatum*.

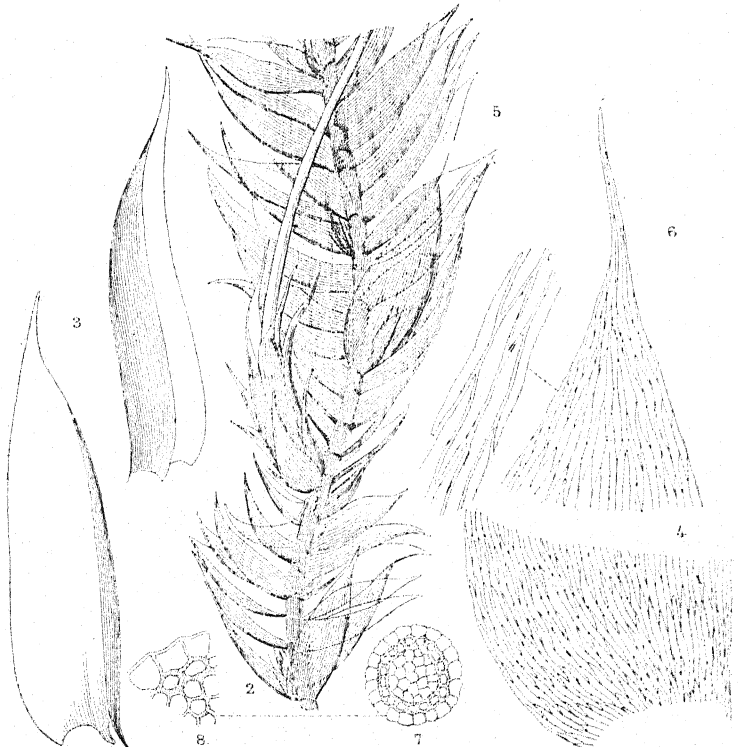


FIGURE 194. *Plagiothecium Muellerianum* (From Sulliv. "Icones"). 7 and 8. Stem sections

P. Muellerianum Schimp. In crevices of moist ledges in cool ravines or on shaded mountain sides will be found flattened strands of this yellow-green moss; these often taper into flagella or stolons; tufts seldom of any considerable size; leaves ovate-lanceolate, nondecurent, concave, *entire*, plane-margined and rather abruptly apiculate-acuminate; leaf cells very long and narrow, 20:1,

alar cells not differentiated; cortical cells of stem very large and thin-walled, 3-4 times as wide as basal leaf cells, easily seen without sectioning: dioicous; capsules rare; spores in autumn. Widely spread in mountain regions but apparently local. Easy to recognize even in the field.



FIGURE 195. *Plagiothecium elegans* (From Sulliv. "Icones").

P. elegans (Hook.) Sulliv. Small and delicate, about the size of the last or somewhat larger and growing in somewhat similar but more moist situations and usually in larger masses, glossy green, often with axillary gemmiferous branchlets; cortical cells of stem not enlarged, thick-walled; leaves complanate, oblong-ovate to oblong-lanceolate, at first gradually narrowing, then rapidly contracted to a

rather short slender acumen, rounded at base and narrowed to the insertion, not decurrent, plane-margined; costa prominent for the subgenus, short and double or occasionally reaching nearly the middle of the leaf; leaf cells linear-flexuose, 20:1: dioicous; capsules ovoid, nearly symmetric, inclined to pendent, contracted under the mouth when dry; spores in spring. Local throughout our range.

The smaller form, with leaves ovate to ovate-lanceolate, slenderly acuminate-apiculate, concave, serrate above, usually without gemmiferous branches, which Austin distributed as var. *gracilens* is said by Mrs. Britton to be the type form instead of the more common form described above. The leaves figured are more evenly narrowed than most forms I have seen.

P. micans (Sw.) Paris. Plants small and slender like the two preceding species, growing in thin mats, *yellowish green to whitish green*, glossy; stems prostrate, irregularly branching; stem leaves thin, distant spreading, ovate-lanceolate, 1-1.3mm long, *gradually long-acuminate, somewhat serrulate above*; costa usually lacking; basal cells shorter and broader, *a well-marked line of short broad cells at insertion of leaf* which often fails to come off with the leaf; cortical cells of stem fully as wide as median leaf cells; a very few quadrate cells at basal angles; branch leaves less slenderly acuminate and more strongly serrulate: monoicous; *seta long and slender, seta and capsule light reddish brown*; capsules small, *short-ovoid*, more or less contracted under the mouth when dry and empty; operculum *conic-apiculate to short-rostrate*; *annulus lacking*; spores in January. On rotten wood and soil at base of trees from Long Island southward, principally near the coast, abundant in the southern states. The leaves of *P. micans* vary considerably in slenderness and length of leaf cells. I do not find the perichætal leaves as sharply serrate as figured by Sullivant.



FIGURE 196. *Plagiothecium micans* (From Sulliv. "Icones")

Var. *fulvum* (Hook. & Wils.) Paris. A large form with stems and branches longer, much wider and more complanate, approaching in size and appearance forms of *P. denticulatum*, but lighter colored, or more brownish when old, is found in the southern portion of our range, though more abundant farther south. It is found in swamps and sphagnum bogs and is sometimes floating.

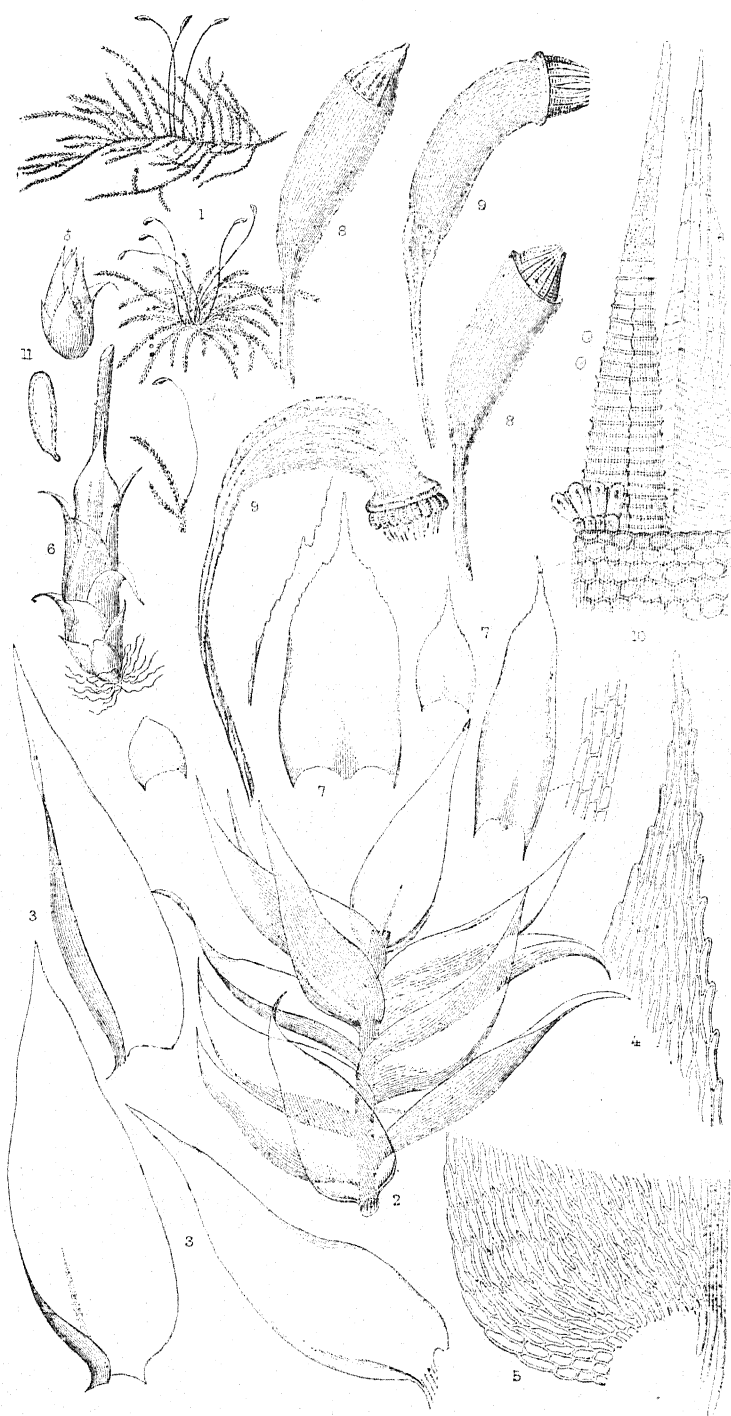


PLATE LXXXIII. *Plagiothecium turfaceum* (From Sulliv. "Icones")

P. Groütii Card. & Ther. is closely allied to the last and perhaps best considered as a subspecies. It is more slender; the stem leaves are broadly ovate-lanceolate, 0.7–0.9^{mm} long, rather abruptly narrowed to a short serrate acumen; operculum beaked with beak as long as rest of operculum. Depressions in base of chestnut tree, Hempstead, Long Island, N. Y.

P. turfæum Lindb. Much resembles *P. micans*, but is a more northern plant extending northward into Canada. It is light green to yellowish green, grows on decayed wood or humus, and has cortical cells of stem fully as wide as median leaf cells; basal cells shorter and broader; but it is easily distinguished from *micans* by the leaves *strongly serrate above*, serrulate below, usually without differentiated alar cells; also by the longer capsule *slightly striate* when dry and empty, *having a neck that shrinks conspicuously in drying*, even when full of spores, and by a *large double annulus* and a conic operculum; spores in summer. Not rare, but apparently little collected. Some of our forms are scarcely complanate and therefore often puzzling.

P. pulchellum (Dicks.) B. & S. is a rare species with us. It is about the size of *turfæum*, but is a *bright glossy green with a metallic luster*; stems prostrate; branches nearly or quite erect, resembling the pile of a very coarse velvet; *leaves not complanate, often slightly secund, narrowly ovate-lanceolate, slenderly acuminate*, scarcely concave, slightly rounded at base and narrowed to the insertion, *entire*, plane margined, ecostate; leaf cells 15–20:1, about *two rows at base shorter and broader but alar not differentiated*: monoicous; capsules variable in length, usually inclined and somewhat unsymmetric, slightly contracted under the mouth when dry and empty; spores in early summer. On decayed wood mainly, also on roots of trees and rocks.

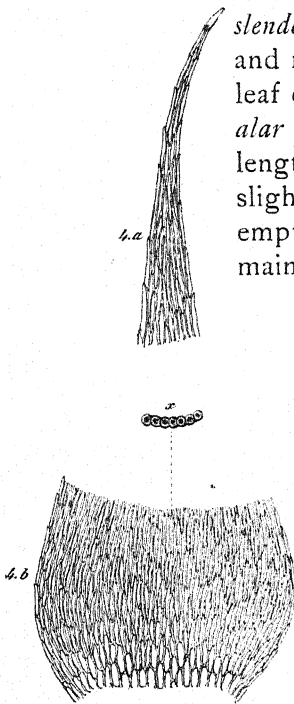


FIGURE 197. *Plagiothecium pulchellum* (From Bry. Eur.)

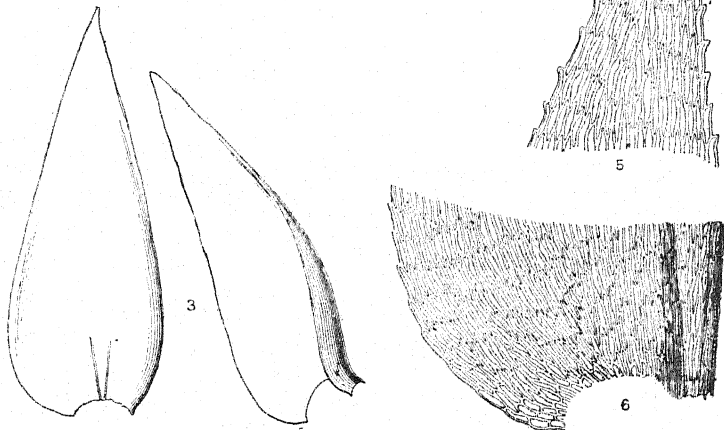


FIGURE 198. *Plagiothecium geophilum* (From Sulliv. "Icones")

P. geophilum (Aust.). Larger than the three preceding species, *dark green*; leaves complanate and *rather distant*, somewhat narrowed to the insertion and rounded at base, oblong-lanceolate, *gradually and evenly narrowed to the rather blunt apex, serrate in the upper half*; margins plane; costa short and double, *but stronger than in most Plagiothecia*; leaf cells rather shorter than in preceding

forms; alar scarcely differentiated: capsules ovoid, inclined, unsymmetric; *operculum beaked*; *annulus large and double*. Rare, growing on moist banks and stones in or near water, apparently a plant of lowlands. Some or all of the leaves are blunt at apex as figured and the apex strongly resembles in appearance that of *Eurhynchium hians*, but many of the leaves are much more slender at apex. The larger size, darker color and characteristic leaf apices distinguish *geophilum* from all the preceding species. The leaf apices and color distinguish it from the next.



FIGURE 199 *Plagiothecium depanatum* (From Sulliv. "Icones")

P. deplanatum (Sch.) Grout. Bright *shining golden green*; leaves complanate, *close and overlapping much more than in the last*, in outline much like those of *elegans* but larger, oblong-lanceolate to ovate-lanceolate, gradually long-acuminate in some cases, in others abruptly narrowed above, *concave, serrate above*, not decurrent, plane-margined; median cells linear-flexuose; costa lacking or nearly so: dioicous; rarely fruiting; capsule unsymmetric and inclined, contracted under the mouth and *somewhat plicate when dry*; *annulus lacking*; operculum short-beaked. In thin mats over clayey ground and stones. Rather infrequent; capsules

rare. Distinguished from all the other species of the subgenus, except *geophilum*, by its size. These two species approach *Euplagiothecium*.

Forms referred to this species vary a great deal and it is probably a composite. One of these forms issued as No. 174 (*P. deplanatum*) in my N. Am. Musci Pleur. seems to approach *P. densifolium* (Lindb.) Limpr., while others approach *P. Silesiacum* (Seliger) B. & S., though to my mind entirely distinct. Dr. Best drew up a comparison in parallel columns between ordinary *deplanatum* and my No. 174, which I here reproduce with some slight changes. Dr. Brotherus regards No. 174 as *deplanatum*.

P. DEPLANATUM

Yellowish green.

In thin mats; stems and branches densely radiculose on the under surface. Plants generally smaller.

Leaves smaller, nearly symmetric, gradually acute to short acuminate.

Median cells loose, rather wide, 8-12:1; alar cells quadrate-oblong, not clearly differentiated.

Central strand absent or rudimentary.

N. AM. MUSCI PLEUR. NO. 174

Deep dark green.

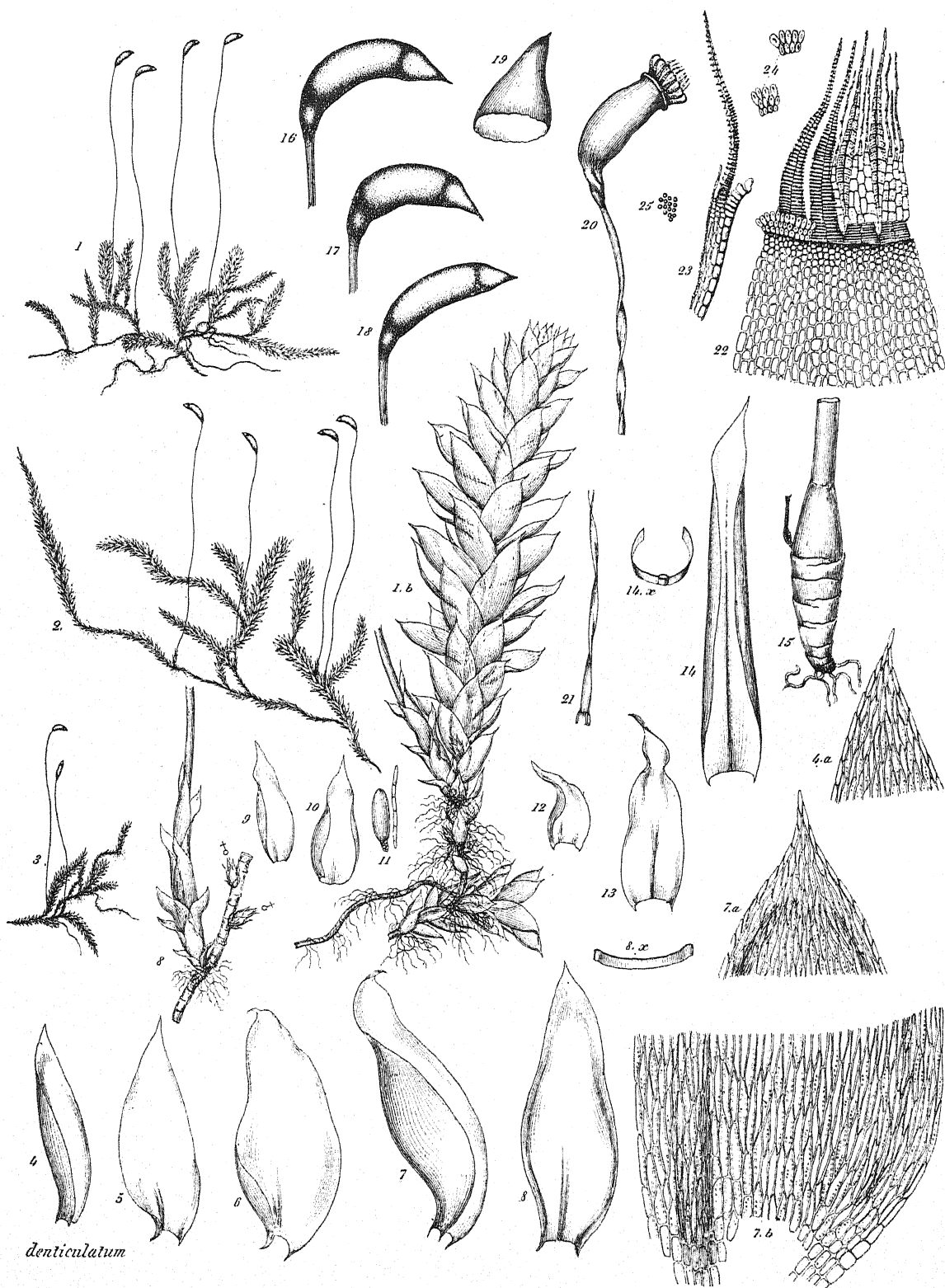
In denser tufts; stems and branches not densely radiculose on under surface. Plants generally larger.

Leaves larger, longer, distinctly asymmetric, rather abruptly long and slenderly acuminate.

Median cells close, narrow, 10-15:1; alar cells small, quadrate, thick-walled, clearly differentiated.

Central strand distinct.

P. denticulatum (L.) B. & S. One of our most common mosses, found everywhere, exceedingly variable and possibly a composite species, as several European authors have split off other species besides those mentioned below. It grows in wide loose glossy-green mats; much larger than any species of *Isopterygium*, except possibly the last two; branches ascending, branch leaves neither distant nor crowded, complanate, somewhat spreading, *little shrunken in drying*, usually slightly concave and asymmetric, 1.5-2.5^{mm} long, oblong-ovate, acute to short-acuminate, broadest at base and decurrent with one or both margins narrowly recurved, entire, or usually with a few teeth at the extreme apex; costa variable, sometimes lacking, sometimes double or forked and reaching $\frac{1}{3}$ the length of the leaf; median cells linear-rhomboidal, 120-160 μ x 10-15 μ , thin-walled, full of chlorophyll, gradually becoming broader and shorter toward the base; basal cells subrectangular and pellucid, *alar hyaline and decurrent*; *monoicous*; capsule about 2^{mm} long, cylindric with a distinct neck, inclined to subhorizontal, curved to nearly symmetric, often striate when dry and empty; *operculum long-conic*, occasionally short-beaked; *annulus large*; spores in summer. On the ground, roots of trees, stones, etc., in damp shaded places. The amateur will collect this on every trip, thinking he has something different each time. The plants vary in size, in color, in shape of leaves and in arrangement and position of leaves, size and curvature of capsules and length of beak of operculum.



denticulatum

PLATE LXXXIV. *Plagiothecium denticulatum* (From Bry. Eur.)

Forma *propagulifera* Ruthe, leaves strongly unsymmetric, very strongly decurrent, bearing 3-4-celled brood bodies on the back of the leaves. Long Island swamps, probably elsewhere in similar situations.

Var. *Dónii* (Smith) Lindb. (*Hypnum obtusifolium* Brid.) Very glossy, leaves soft, ovate, blunt or rounded at apex, often apiculate, concave. Alpine or sub-alpine, not common.

Several other varieties are described, based on the variations mentioned above. In crevices in wet cliffs and ledges in cool shaded mountain regions I find a small smooth soft shining form that is probably var. *tenellum* B. & S.

P. sylvaticum (Huds.) B. & S. Schimper says of this species that it is distinguished from *denticulatum* by its softer, less glossy leaves, shrinking when dry; by its dioicous inflorescence, long-cylindric striate capsule, beaked operculum and narrower annulus. Limpricht and Roth say that the capsules of *sylvaticum* are striate and of *denticulatum* not striate. Husnot says of both species, capsules smooth or striate. Abbé Boulay, one of the most careful of observers, says the same. Spruce and Dixon say that a striate capsule is always found on a monoicous plant. I do not believe inflorescence is a valid character for distinguishing species unless plainly correlated with other characters. I have examined several plants of a tuft and found them all female, only to examine another and find on it both antheridia and archegonia. Boulay says that he finds in the same tuft male plants, female plants, and others which are bisexual. I find both monoicous and dioicous plants with striate capsules. If we add to Schimper's description, as given above, that the plants of *sylvaticum* are usually larger, duller or more yellowish green; leaves shrinking when dry so as not to overlap, or barely overlapping, we should have a description of a plant that every one would recognize as *sylvaticum*. As Husnot puts it: "If *P. denticulatum* and *sylvaticum* always presented the characters I have indicated, their distinction would not be difficult; but one often finds plants that lack one or more of these characters. The characters indicated as separating the two plants are exceedingly variable, even in the case of the inflorescence." To my mind *sylvaticum* is but a poorly delimited subspecies of *denticulatum* with all manner of common intergradations. *Roeseanum*, *lætum* and *Rothii* I consider in the same light.

P. Roeseanum (Hampe) B. & S. (*P. Sullivantiae* Schimp.) is another subspecies of *denticulatum* closely related to *sylvaticum*. Dioicous; scarcely complanate, sometimes nearly julaceous, often brittle, leaf cells narrower, 15:1; beak of operculum shorter.

P. lætum B. & S. Monoicous; smaller than typical *denticulatum*, leaves slenderly long-acuminate, less strongly decurrent; capsules erect or nearly so, peristome without cilia.

P. Ruthei Limpr. A fine large moss growing in low-lying coastal swamps of Long Island and probably elsewhere; leaves complanate with both sides of each

leaf incurved and clasping the base of the leaf above, asymmetric, about 2.5mm long; costa extending $\frac{1}{3}$ – $\frac{1}{2}$ the length of the leaf.

The *Fissidens* habit of the leaves gives the plants a peculiar easily recognizable *facies* when fresh, different from any monoicous forms I have seen inland, but approached by forms of *denticulatum* growing in similar situations in neighboring localities. The leaves often bear brood bodies. Reported from Minnesota by Holzinger.

P. latebricola (Wils.) B. & S. Slender, resembling *Isopterygium* in appearance, in dense tufts of a light glossy green, yellowish when dried; branches numerous, short; leaves more or less complanate, concave, spreading, somewhat subsecund at end of branches, about 1mm long, ovate-lanceolate, rather slenderly acuminate, *decurrent*, *entire*, ecostate or nearly so; median cells linear-flexuose, 10–15:1; basal broader and shorter; *decurrent alar cells large, clearly defined, rectangular, hyaline*; numerous *oblong-cylindric several-celled* (about 4) *brood-bodies are borne abundantly on the tips of the leaves and sometimes on other parts of the plant*: dioicous; capsules small, *erect and symmetric*; peristome teeth distantly

articulate, cilia lacking or rudimentary; annulus small; spores in late autumn or summer. Swamps, about roots of trees, on decaying wood, hummocks of fern, etc. Distinguished from all the species of *Isopterygium* by its enlarged and decurrent alar cells.

P. striatellum (Brid.) Lindb. Growing in rather dense dark green tufts; branch leaves, in American specimens, *squarrose-spreading*, giving the plants the habit of a *Campylium*, long-acuminate from an ovate base, or sometimes elongated triangular-ovate, narrowed and strongly decurrent at insertion, *serrulate*, especially above; costa short and double or lacking; median leaf cells linear-flexuose, *rather short for the genus*, 5–10:1; basal shorter and broader; *alar suddenly inflated, hyaline or colored, forming very distinct decurrent auricles*: monoicous; capsules inclined and curved, *always plainly striate when dry*; spores, May-June. Common in swamps. In general appearance this species resembles *Campylium* rather than *Plagiothecium* but the abundant striate capsules easily distinguish it from any of our *Campylia*.

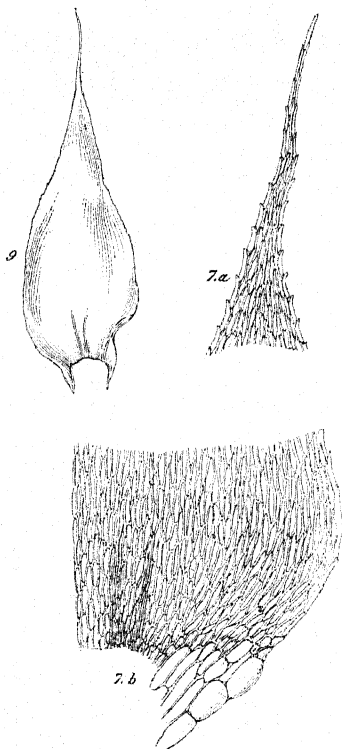


FIGURE 200. Leaf and leaf apex and base of *Plagiothecium striatellum* (From Bry. Eur.)

AMBLYSTEGIÉLLA Loeske

Usually treated as a section of *Amblystegium*, but differing from the true *Amblystegia* in the smaller

size, lack of central strand and in the slightly developed costa, which is either wanting or very faint. Nearly all our species, except *adnata*, have a tendency to become stoloniferous and the leaves on the stolons are much smaller than the normal leaves. Therefore, well-developed leaves should be sought for study.

KEY

1. Plants of the size and habit of *Hypnum reptile*; leaves reaching more than 1^{mm} in length *adnata*.
Plants minute; leaves not over 0.6^{mm} in length 2.
2. Plants growing on bases of hardwood trees; leaves reaching 0.6^{mm} in length . . . *subtilis*.
Growing on stones, especially limestone; leaves usually less than 0.5^{mm} in length 3.
3. Leaves narrowly triangular-lanceolate, not narrowed to insertion; alar cells at margin all longer than broad; median 5-10:1 *minutissima*.
Leaves narrowed to insertion; median cells shorter, alar quadrate 4.
4. Quadrate alar cells conspicuous: monoicous; capsules curved and inclined . . . *confervoides*.
Quadrate alar cells few, or lacking in some leaves: dioicous; capsules erect or nearly so *Sprucei*.

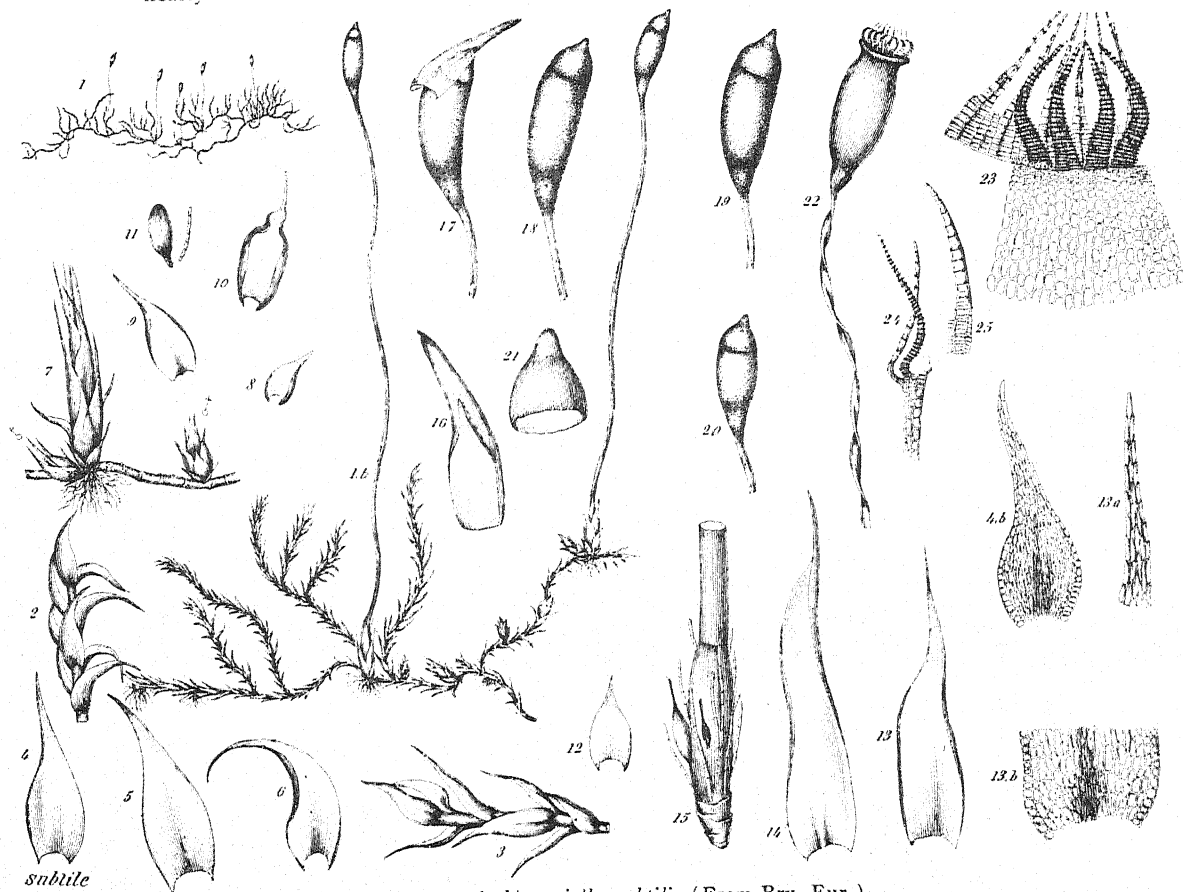


FIGURE 201. *Amblystegiella subtilis* (From Bry. Eur.)

A. subtilis (Hedw.) Loeske. Plants small, in thin closely woven dark-green mats; leaves rather distant, lanceolate to linear-lanceolate, slenderly long-acuminate, narrowed to the insertion, not decurrent, entire, appressed when dry, 0.25–0.6mm long; costa short and faint or lacking; median cells oblong-hexagonal, 2–3:1; alar cells quadrate to transversely elongated: monoicous; capsule oblong-cylindric, nearly or quite symmetric and erect; annulus present; cilia rudimentary or lacking; spores from August to September. On bases of hardwood trees in cool swampy places; not rare.

A. confervoides (Brid.) Loeske is the only other one of our minute species

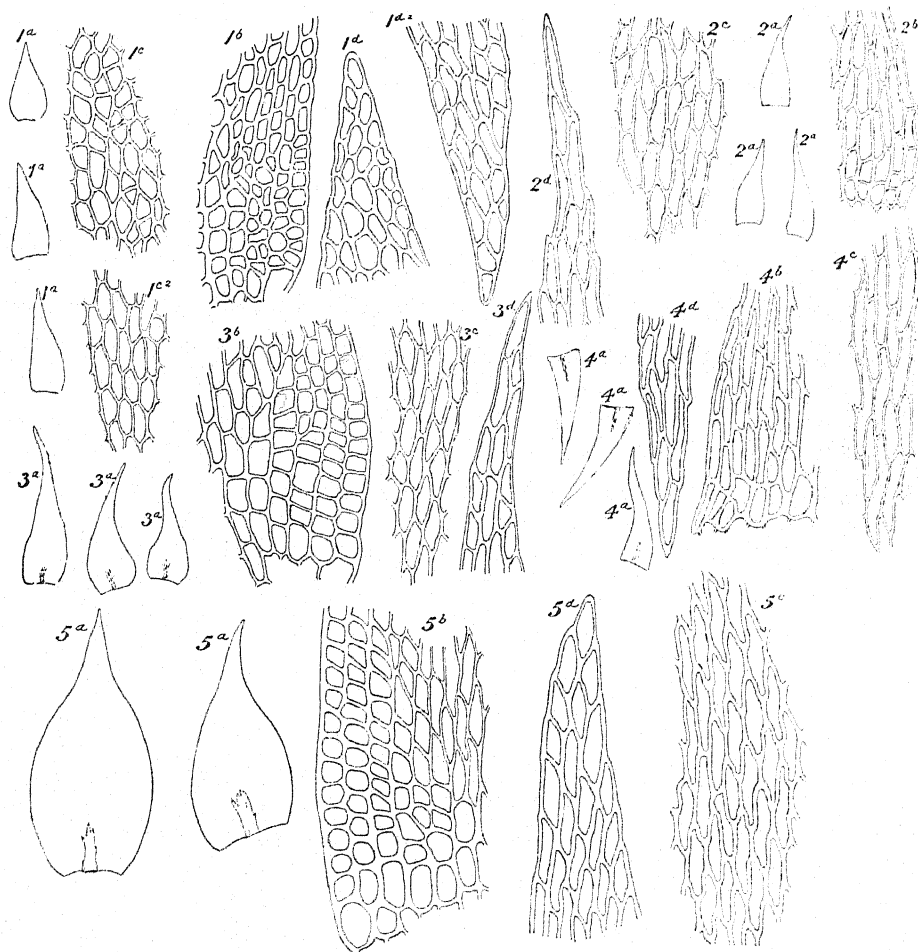


FIGURE 202. *Amblystegiella* (after Cheney). 1. *A. confervoides*: a, leaf; b, cells from alar region; c, median cells of American plant; c², median cells of European plant; d, apical cells from American plant; d² apical cells from European plant. 2. *A. Sprucei*: a, leaf; b, alar cells; c, median cells; d, apical cells. 3. *A. subtilis*: a, leaf; b, alar cells; c, median cells; d, apical cells. 4. *A. minutissima*: a, leaf; b, alar cells; c, median cells; d, apical cells. 5. *A. adnata*: a, leaf; b, alar cells; c, median cells; d, apical cells. Leaves by 43 diameters and leaf cells by 290 diameters.

occurring with any frequency. It is a smaller plant than the last, growing on moist stones or ledges. Its leaves will average about $\frac{2}{3}$ the length of those of *subtilis*, are ecostate and nearly or quite entire; quadrate or transversely elongated cells numerous; capsules *curved and inclined*; *peristome with cilia*; spores in summer. By reference to Cheney's figures it will be seen that he illustrates two forms: the "European" form with cells more elongated and apex more slender, and an American form with shorter and more irregular leaf cells and broader acumination. My N. Am. Musci Pleur. No. 317 has the leaf cells of the "European" form and a leaf apex as slenderly acuminate as Cheney figures for *A. Sprucei*, though not more slender than the *confervoides* of the Bry. Eur. Also the margin is plainly denticulate and the quadrate alar cells less numerous than figured. This form approaches *A. Sprucei*, but is plainly not that species because of the well developed area of quadrate alar cells and the curved capsules with well developed cilia in the peristome. No. 820 of Macoun's Canadian Musci and a plant collected near Montreal by Dupret are the extreme form with the short acuminate leaves and short leaf cells figured by Cheney in 1a, 1b, 1c and 1d. In the various European authors consulted I can find no description which will fit this form; indeed, at first sight it is difficult to believe it is the same species as is commonly described by Europeans. For this form I propose the name, *forma brevifolia*.

A. Sprucei is about the size of *confervoides* and grows on similar substrata. The leaves are *somewhat serrulate* and the apical cell usually long and narrow; the quadrate or rectangular alar cells are fewer, none transversely elongated and few as broad as long; median cells 6-8:1; perichæcial leaves spinose-denticulate above: dioicous; capsules *erect* or nearly so; *peristome without cilia*. Rare.

A. minutissima (Sulliv. & Lesq.) Nichols, is a very rare species differing from all the above in that the leaves are broadest at base, not being narrowed to the insertion, narrowly triangular-lanceolate, with no quadrate cells at the marginal angles. As figured by Sullivant the marginal alar cells are twice as long as broad; the median cells are 4-8:1: monoicous; capsules minute, 0.5^{mm} long, ovoid, symmetric or slightly curved, turbinate when dry and empty; annulus and cilia present. "On limestone rocks in shaded ravines."

Leskea tectorum var. *flagellifera* Best, is likely to be confused with the preceding species, especially *A. confervoides*. It is apparently more common than was known when I wrote up *Leskea*. The leaves of the flagella are ovate, *acute to short acuminate*; median cells *scarcely longer than broad, and irregular in shape*. At the angles is a large area of cells, quadrate, triangular, transversely elongate, etc. Cheney's figures of *confervoides*, except 1c² and 1d², would fit this *Leskea* pretty well, but usually some fairly well-developed plants with costate leaves can be found in the tufts to identify them.

A. adnata (Hedw.) Nichols. *Larger than the preceding with the facies of*

Hypnum reptile; growing in wide thin closely adherent mats of a dark green to yellowish green; stems creeping, closely branched; leaves crowded, erect-spreading, oblong-ovate, broadly short-acuminate, margins often recurved below, concave, entire or nearly so, about 1 mm long; median cells subrhomboidal, 4-7:1; apical shorter; alar quadrate, very numerous, sometimes extending $\frac{1}{3}$ the length of the leaf; the entire areolation unusually regular; costa faint or lacking: monoicous; perichæatial leaves dentate; capsule oblong-cylindric, inclined and curved; annulus present; operculum conic, not rostrate; peristome perfect; spores in summer. Common on stones and bases of trees. Distinguished from *Hypnum reptile* by its terete branches and entire short-acuminate leaves, from *A. subtilis* by its larger size and more numerous quadrate alar cells, curved capsules and perfect peristome.

Plants growing on stones sometimes have the leaves as broadly ovate and abruptly short-acuminate as figured by Cheney (Fig. 202), with the quadrate alar cells very numerous and the cells of the upper one-third of the leaf rounded diamond-shaped as figured by Sullivant (Fig. 203). On trees the leaves are often more gradually narrowed to a longer acumen, becoming oblong-lanceolate as figured by Sullivant. In this form the quadrate alar cells are much less numerous

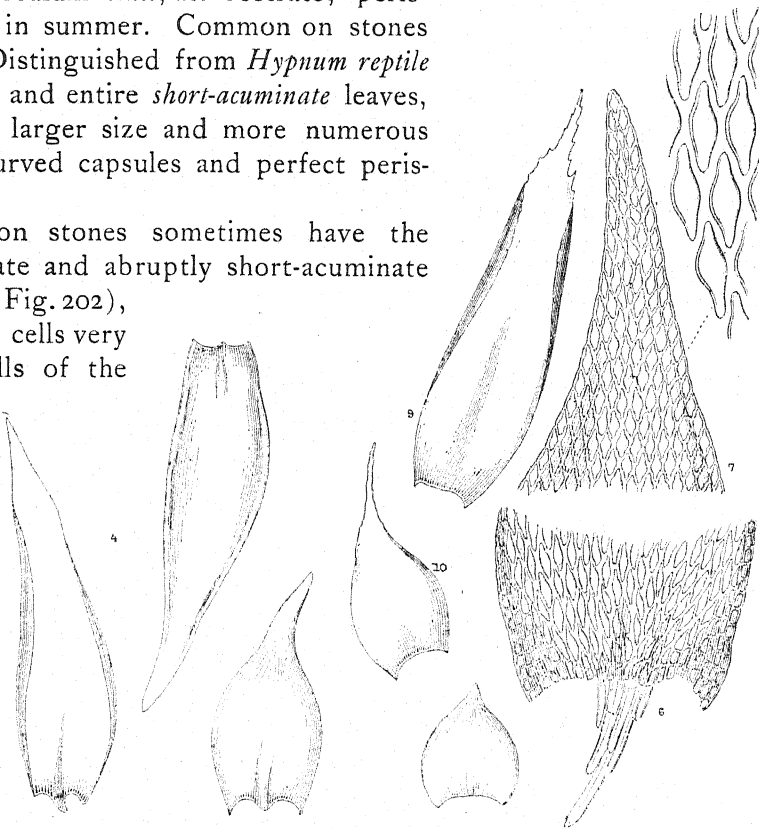


FIGURE 203. *Amblystegiella adnata* (From Sulliv. "Icones")

ous and the median and upper cells more elongated, much as figured by Cheney.

Raphidostegium Carolinianum admixtum has leaves very similar to those of some forms of this species, but the differentiated alar cells are less in number, with the lowest strongly inflated. *Platygyrium repens*, when sterile, is often difficult to distinguish from *A. adnata*, but the more slender acumination and longer leaf cells of *Platygyrium* will usually be sufficient for identification. Some of the forms intermediate between *A. adnata* and *Hypnum reptile*, or between *A. adnata* and *Platygyrium*, cause one to wonder if they are not hybrids.

Some of the slender varieties of *Hypnum cupressiforme* with nearly symmetrical leaves simulate *A. adnata*, but the leaf apex in that species is often serrate, usually more slender and the upper leaf cells more elongated.

SUBFAMILY 7. ENTODONTEAE

Plants of large or medium size, none minute, typically hypnaceous; leaves not papillose, often concave or plicate or both; costa lacking or short and double; median leaf cells linear; alar quadrate (in our forms): seta smooth; capsule erect, straight, not conspicuously contracted under the mouth when dry; peristome with cilia rudimentary or wanting, segments often narrow and basal membrane sometimes nearly lacking.

This group has contained a heterogeneous collection of mosses of various relationships, their association being based upon the erect capsule and incomplete peristome. I have shown elsewhere that a degeneration of the inner peristome is associated with erect capsules even though it may not (as I think it is) be a result as well. There is no more reason why *Homalothecium* or *Climacium* should be placed in

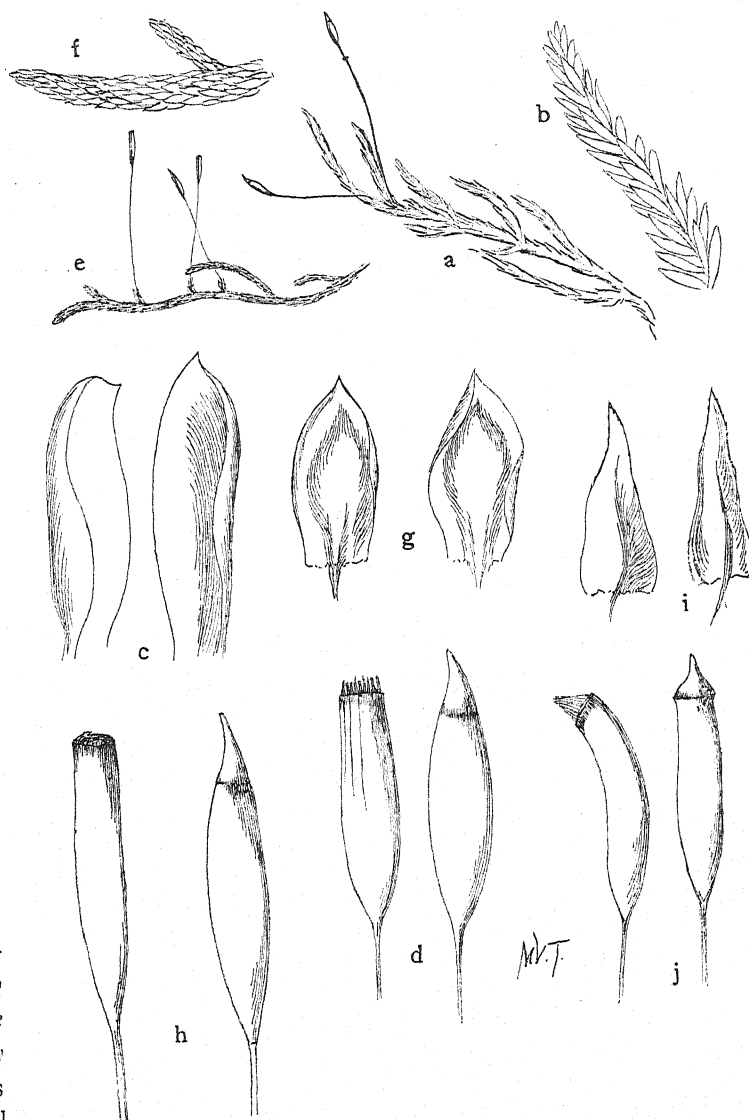


FIGURE 204. a. *Entodon cladorrhizans* $\times 1$. b. Branch $\times 5$. c. Leaves $\times 20$. d. Capsules $\times 10$. e. *E. seductrix* $\times 1$. f. Branch $\times 5$. g. Leaves $\times 20$. h. Capsules $\times 10$. i. Leaves of *Brachythecium acuminatum* $\times 20$. j. Capsules of the same $\times 10$.

this subfamily than there is for doing the same with *Brachythecium acuminatum* or even *Plagiothecium latebri-cola*.

KEY TO GENERA

1. Plants robust, glossy yellow-green; leaves symmetric but very concave *Entodon*.
Plants slender, dark green, rarely glossy 2.
2. Leaves somewhat falcate, ends of branches curved when dry *Pylaisia*.
Leaves not falcate, branches not curved *Platygyrium*.

ÉNTODON C. M. (*Cylindrothecium* B. & S.)

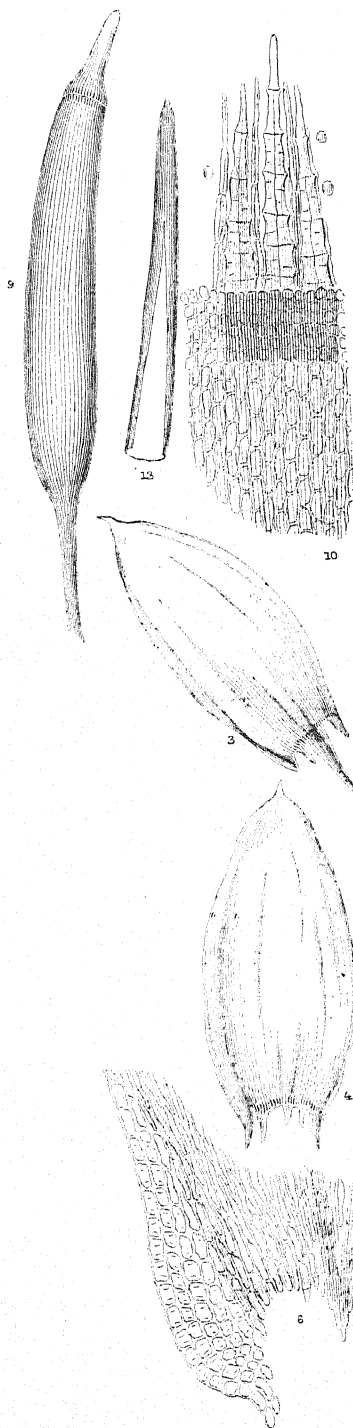
Growing in wide intricate glossy yellow-green mats; stems densely leafy, *turgid with the very concave leaves* or in most species *somewhat flattened*. Leaves nearly entire or very slightly serrate at apex, very concave, not *striate or plicate when dry*, ecostate or with costa very short and double; leaf cells linear, *enlarged and quadrate at the basal angles*: capsules cylindric, erect and symmetric; operculum conic to conic-rostrate, annulus usually large and conspicuous, remaining attached longer than is usually the case; peristome with *cilia rudimentary or wanting and segments narrow*, basal membrane usually very narrow.

Their brilliant color and flattened habit (julaceous in *E. seductrix*) render this genus easy of recognition. The leaves are so much nearer together than in most other flattened forms, that one is not likely to put them with forms like *Plagiothecium*. In fruit *Brachythecium acuminatum* is our only moss likely to be misplaced in this genus.

KEY

1. Leaves gradually narrowly acuminate; segments of endostome adhering to the teeth *brevisetus*.
Leaves merely acute or apiculate; segments free 2.
2. Leafy stems and branches rounded (terete) *seductrix*.
Leafy stems flattened 3.
3. Plants robust; capsules 3-5^{mm} long, 5-6:1, peristome teeth not papillose above *cladorrhizans*.
Plants more slender; capsules 2.5^{mm} long, 4:1, teeth papillose *compressus*.

FIGURE 205. "*Entodon seductrix*" (From Sulliv. "Icones")



E. seductrix (Hedw.) C. M. is readily known from all other species of *Entodon* by its cylindric julaceous stems and branches, although it varies greatly in many respects. It grows in wide glossy yellow-green mats; branch leaves imbricate-appressed, oblong-elliptical to ovate, about 1.2–0.7mm, short-apiculate, entire or very slightly denticulate near apex; costa short and double; median cells linear, quadrate alar cells numerous: monoicous; capsule cylindric, 3–3.5mm long, 5–6:1; annulus of two or three rows of small cells obscured by the base of the teeth; teeth of peristome short and very characteristic, as illustrated in Fig. 205; deeply inserted and with few articulations above; segments linear, about the length of the teeth. Sullivan's figure of the mouth of the capsule shows the annulus cells as a part of the capsule wall, but two or three rows of these have the structure of annulus cells. The spores mature in autumn or early winter. Common, especially in the southern part of our range, on rotten wood, soil, bases of trees, etc.

Var. *lanceolatus* Grout. Stem leaves ovate-lanceolate, acute; branch leaves broadly lanceolate, tapering gradually to the serrate acute apex; median cells 12:1; capsule 3–5mm long, about 8:1. On rotten wood, Hanging Rock, Ill.

Var. *minor* (Aust.) Grout. Entire plant much reduced, dirty green: leaves, seta and capsule shorter than in type; capsule 1.5–2mm long, its length about 3 times its diameter. Ohio (Sulliv.); near Augusta, Ga. A portion of No. 388 of Sulliv. and Lesq. Musc. Bor.-Am., in Columbia Herb., issued as *Cylindrothecium compressum* Br. and Sch. is this variety.

Var. *Demètrii* (Ren. & Card.) Grout. *Cylindrothecium Demètrii* Ren. & Card. Stems irregularly divided and branched, strongly complanate-foliate, slender, having almost exactly the facies of *E. compressus*; leaves ovate, gradually acute, very entire; peristome teeth often irregularly perforate. On stones at top of well, Emma, Mo.

E. cladorrhizans (Hedw.) C. M. This is our only other common *Entodon*; readily recognizable by its glossy yellow-green color and broadly flattened appearance; branch leaves oblong-ovate, reaching 1.5 by 0.8mm, acute, nearly entire, very concave; quadrate alar cells numerous. The peristome teeth have about the usual number of articulations for a hypnaceous moss, not papillose; annulus large; spores maturing in autumn. Typically growing on rotten logs, sometimes found on soil or roots of trees.

E. compréssus (Hedw.) C. M. has much the same appearance as the last, but is very much more slender; branch leaves only 1.1 by .5mm; capsules shorter and peristome teeth densely papillose above with minute papillæ. With much the same habitat and range as

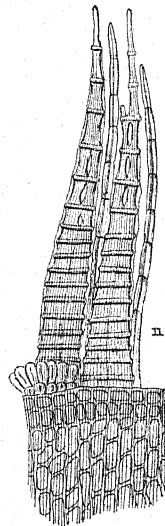


FIGURE 206.
Peristome of *Entodon cladorrhizans*. (From Sulliv. "Icones")

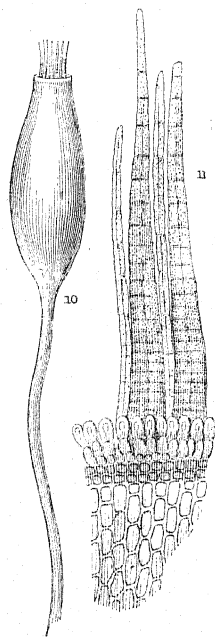


FIGURE 207. *Entodon compressus* (From Sulliv. "Icones")

the last but rather rare and infrequent. Not reported north of Rhode Island.

E. brevisetatus (Hook. & Wils.) J. & S. is a rare species with the characteristic habit of the genus but with the leaves long-acuminate and the segments of the inner peristome adherent to the teeth after the manner of *Pylaisia Schimperii*. Extending over the most of our range, but rarely found. There seem to be some indications that it prefers a limestone country. The incomplete formations of the inner peristome in this species and in two species of *Pylaisia* are of great interest, as showing a step in peristome degeneration in an erect capsule between the condition in which the segments are narrow and cilia lacking, as in most *Entodons*, and the condition of complete suppression as in *Leucodon*.

PLATYGÝRIUM B. & S.

P. repens (Brid.) B. & S. The microscopic structure of this plant is so like that of *Entodon* that I placed it in that genus in my monograph (Bull. Torr. Bot. Club 23:227), but the dark-green scarcely glossy appearance and the small terete branches much more closely resemble *Pylaisia* than *Entodon*.

From *Pylaisia* this species is distinguishable by the fact that the leaves are not at all falcate-secund and the branches are little if any curved at the ends. The ends of the branches often bear gemmæ in the axils of the leaves. The

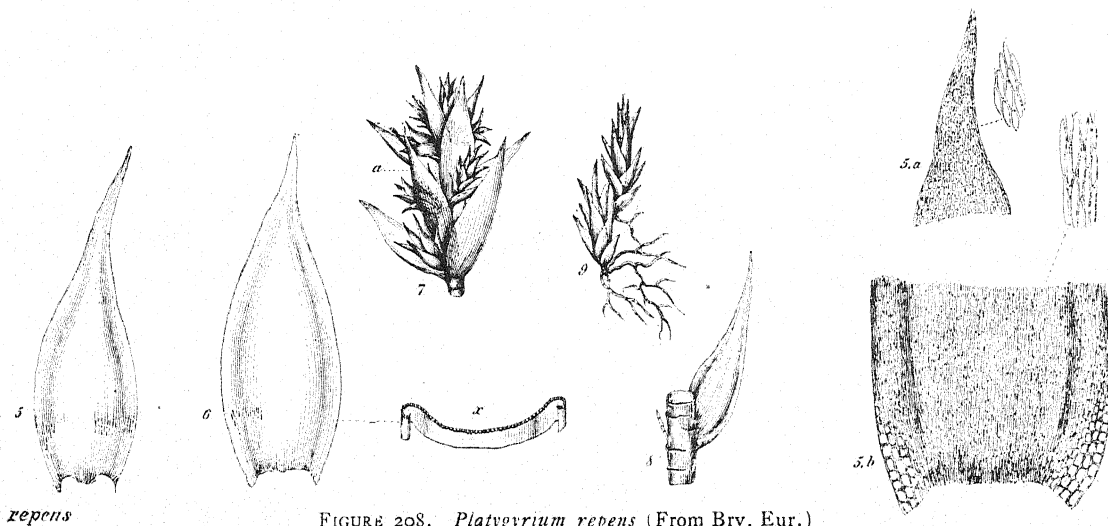


FIGURE 208. *Platygyrium repens* (From Bry. Eur.)

leaves are 0.7–1.2 by 0.3–0.4^{mm}, oblong-ovate to oblong-lanceolate, closely imbricate when dry, acute to acuminate, slightly concave with margins entire and reflexed below, not striate or plicate; costa lacking or short and double; apical cells rhomboidal, median linear, 8:1; quadrate alar cells numerous and extending up the margins: capsule erect, 4:1; annulus large; peristome teeth hyaline-margined; segments linear with scarcely any basal membrane; spores in early autumn. Common on bark of trees, decaying logs, and stumps.

The novice might possibly mistake sterile plants for *Amblystegiella adnata*, but the plants are larger, less pinnately branched and otherwise different in general appearance, with much longer median leaf cells and more slenderly acuminate leaves.

PYLAISIA B. & S. (Not Desv.)

A genus of tree-growing mosses sometimes found on fallen trunks, usually easy of recognition by reason of their slender branches, curved when dry and almost hooked at the ends by reason of the falcate-secund leaves and also by their small erect and cylindric capsules, having very degenerate inner peristomes; cilia lacking (or very rudimentary in *polyantha*) and often having the segments adherent to the teeth. The leaves are ecostate or with costa short and double, concave, entire or slightly serrulate above. The annulus is much narrower than in *Platygyrium* or *Entodon* (except *E. seductrix*).

KEY

1. Segments of endostome free from the teeth ?
 Segments of endostome wholly or partially adherent to the teeth 3.
2. Operculum conic; quadrate alar cells few *polyantha*.
 Operculum short-beaked; quadrate alar cells numerous *subdenticulata*.
3. Segments partially adherent; spores 18–24^μ *Schimper*.
 Segments wholly adherent; spores 25–70^μ *intricata*.

P. polyantha (Schreb.) B. & S. This is a moss with a typical hypnaceous peristome except for the rudimentary cilia and the absence of the fine transverse lines at the base of the teeth. The American plant is very close to the European *P. polyantha*, but it differs constantly in the shorter broader and more abruptly-acuminate leaves. The length of the leaf of the European plant averages 1.5^{mm}, while the average length of the leaf in the American form is only 1^{mm} in length. In examining hundreds of American specimens I found but one leaf measuring 1.4^{mm} in length. It grows in glossy yellowish green intricate mats; stems 2 to 10^{cm} long, rarely longer, creeping; branches 0.5 to 1^{cm} long, erect or ascending; branch leaves somewhat falcate-secund, loosely imbricate when dry, broadly ovate-lanceolate, 1–1.3 x 0.4–0.5^{mm}, more or less long-acuminate, entire, slightly concave, ecostate, or costa very faint, short and double; leaf cells linear-



PLATE LXXXV. *Pylaisia Schimper* (From Sulliv. "Icones")

rhomboidal; median cells 8:1; *quadrate alar cells few*; stem leaves broader, more abruptly acuminate: capsule oblong-cylindric, 2.5^{mm} long, 3.5-4:1; operculum *conic to conic-apiculate*; annulus very narrow and easily detached, of one row of cells; teeth of peristome linear-lanceolate, closely and regularly articulate, submoniliform and slightly granular above; *segments as long as teeth, linear-lanceolate*, more or less split when old, granular-roughened; spores in autumn and winter. Apparently widely distributed in Canada and along the northern border of the United States in mountainous regions, but rather infrequent and local.

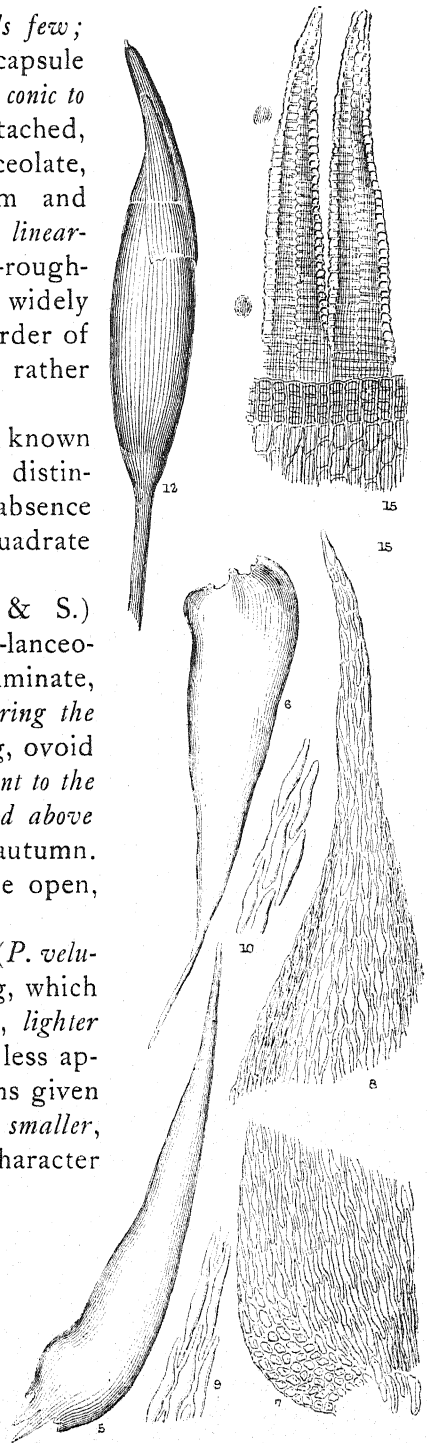
P. subdenticulata Schimp. is a rare and little known species closely related to forms of *P. polyantha*; distinguished by the smaller size, beaked operculum, absence of cilia in the peristome and by the numerous quadrate alar cells.

P. Schimper R. & C. (*P. intricata* B & S.) Growing in thin dark green mats; leaves ovate-lanceolate, reaching 1.1 by 0.4^{mm}, more or less long-acuminate, nearly entire; *quadrate alar cells numerous, bordering the lower one-third of the leaf*: capsule about 2^{mm} long, ovoid to ovoid-cylindric; *segments of the peristome adherent to the teeth for the lower two-thirds, split below and united above between the points of the teeth*; spores maturing in autumn. Common and specially addicted to trees in the open, apple trees, shade trees and the like.

P. intricata (Hedw.) R. & C. (Not B. & S.) (*P. velutina* Schimp.) Less common than the preceding, which it resembles; growing on trees in cool woods, *lighter colored* with leaves narrower (0.8-1.2 by 0.3^{mm}); less appressed when dry. In addition to the distinctions given in the key, the *number of quadrate alar cells is much smaller*, so that the species can be distinguished by this character alone.

The mix-up in names between the last two species is due to the fact that the plant named *intricatum* by Hedwig was what almost all recent authors have called *velutina*. (Fide Cardot.)

FIGURE 209. *Pylaisia intricata* R. & C. (From Sulliv. "Icones")



Family 23. Fabroniaceae

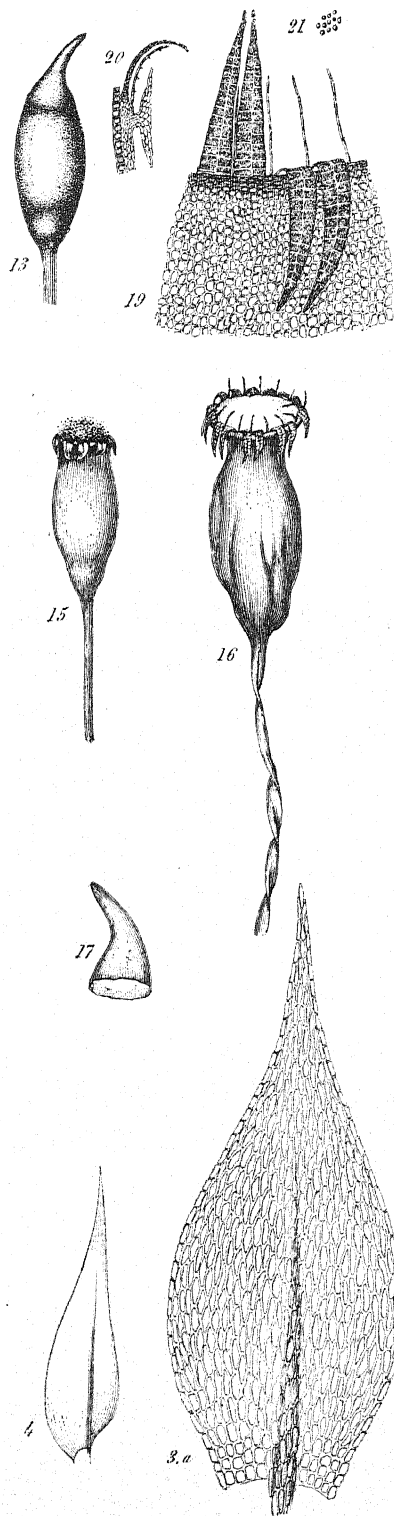
Smallest and most delicate of the Pleurocarpi except *Amblystegiella*. Mostly plants of warmer regions, growing in rather thin tufts, often glossy. Stems without central strand, creeping, producing many erect and simple or somewhat divided branches; paraphyllia lacking; branches densely leafy; leaves *soft*, rarely or not at all complanate or secund, *closely imbricate when dry*, *not decurrent or plicate*, ovate to ovate-lanceolate, acuminate, entire in some species, ciliate-dentate in others; costa lacking or single and extending $\frac{1}{2}$ length of leaf; leaf cells thin-walled (except *Habrodon*), median linear-rhombic to hexagonal; basal and alar often quadrate to short rectangular; none papillose: capsule erect and symmetric, cylindric to ovoid, often strongly contracted under the mouth when dry and empty; peristome single or double, the outer 16 teeth often united in pairs and reflexed as in *Orthotrichum*; segments of inner peristome, when present, narrowly linear. Rare in our range, usually on trees.

KEY TO THE GENERA

1. Leaves ciliate-dentate *Fabronia*.
Leaves entire 2.
2. Leaves costate; leaf cells thin-walled . . . *Anacamptodon*.
Leaves ecostate; leaf cells thick-walled . . . *Habrodon*.

ANACAMPTODON Brid.

A. splachnoides (Froelich) Brid. Our only species, dark green; leaves ovate-lanceolate, acuminate, entire; leaf cells rhombic-hexagonal, quadrate to rectangular at base: seta 5–8mm long; annulus lacking; *peristome double; teeth approaching each other in pairs and reflexed when dry; segments filiform with no basal membrane*; spores papillose, maturing in June. *Moist cavities in*

FIGURE 210. *Anacamptodon splachnoides* (From Bry. Eur.)

decaying wood, especially knotholes in living trees. Widely spread but extremely local and occurring in limited quantities. In some of our forms the leaves are not so long-acuminate as figured, being scarcely more than acute.

FABRONIA Raddi

Very small and delicate, leaves often ciliate-dentate. The only species likely to be found in our range is

F. octoblepharis (Schleich.) Schwaegr. Leaves as figured: peristome single with teeth united in pairs as in *Orthotrichum*. Central states to Minnesota and southwards, rare. There are several species of *Fabronia* in the southern states.

HABRODON Schimp.

H. perpusillus (DeNot.) Lindb. (*H. Notarisii* Sch.). 36
Habit and mode of growth of *Fabronia*; leaves spreading when moist, closely imbricate when dry, ovate to ovate-lanceolate, ecostate, entire or slightly crenulate, leaf cells thick-walled; median fusiform; basal and marginal quadrate to subrectangular, more or less rounded by the thickening of the cell walls: inner perichætal leaves erose-dentate; capsules ovoid; annulus broad; peristome single, of narrow deeply inserted teeth. Trunks of trees, Central states, very rare. The minute size of the plants prevents confusion with species of the *Leucodontaceæ* having a somewhat similar leaf structure.

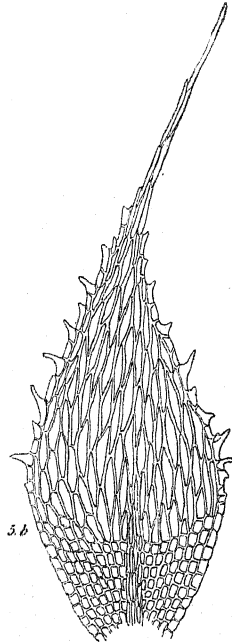


FIGURE 211. Leaf of *Fabronia octoblepharis*. (From Bry. Eur.)

Family 24. Leucodontaceae

Tree-growing mosses, rarely found on rocks, often julaceous and glossy; main stems slender, creeping, irregularly branching; secondary stems numerous, horizontal to drooping and outwardly curved, paraphyllia lacking in most species; leaves of secondary stems ovate to ovate-lanceolate, concave, costate or ecostate, entire or nearly so, closely imbricate when dry, spreading when moist, not papillose; leaf cells short, roundish-oval to fusiform in the middle portion of the leaf: perichætal leaves long-sheathing, seldom much shorter than the seta and often extending beyond the capsule; capsules erect and symmetric, mostly ovoid; peristome simple.

KEY TO GENERA

1. Secondary stems little branched; calyptra not hairy *Leucodon*.
Secondary stems freely branching, often subpinnate; calyptra hairy *Forsstræmia*.

LEUCODON Schwaegr.

The various species of *Leucodon* grow almost exclusively on the bark of deciduous trees, very rarely are any found on dry rocks. The *Leucodons* are seemingly able to do without moisture for considerable periods, as they rarely

or never grow at the base of trees, but at a height of five or six feet and above. The main stems are long, slender, branching, almost filiform, with minute leaves and abundant rhizoids. The secondary stems are numerous, suberect, horizontal, or hanging downward and curved outward, usually julaceous and nearly simple; paraphyllia lacking; leaves many ranked, concave, with margins recurved below, ecostate, entire or slightly serrulate at apex, closely appressed when dry, spreading when moist; leaf cells thick-walled; several rows of marginal cells roundish-quadrate; the lower median linear-fusiform, gradually changing to oval at the apex; basal cells often brownish or reddish yellow. Dioicous.

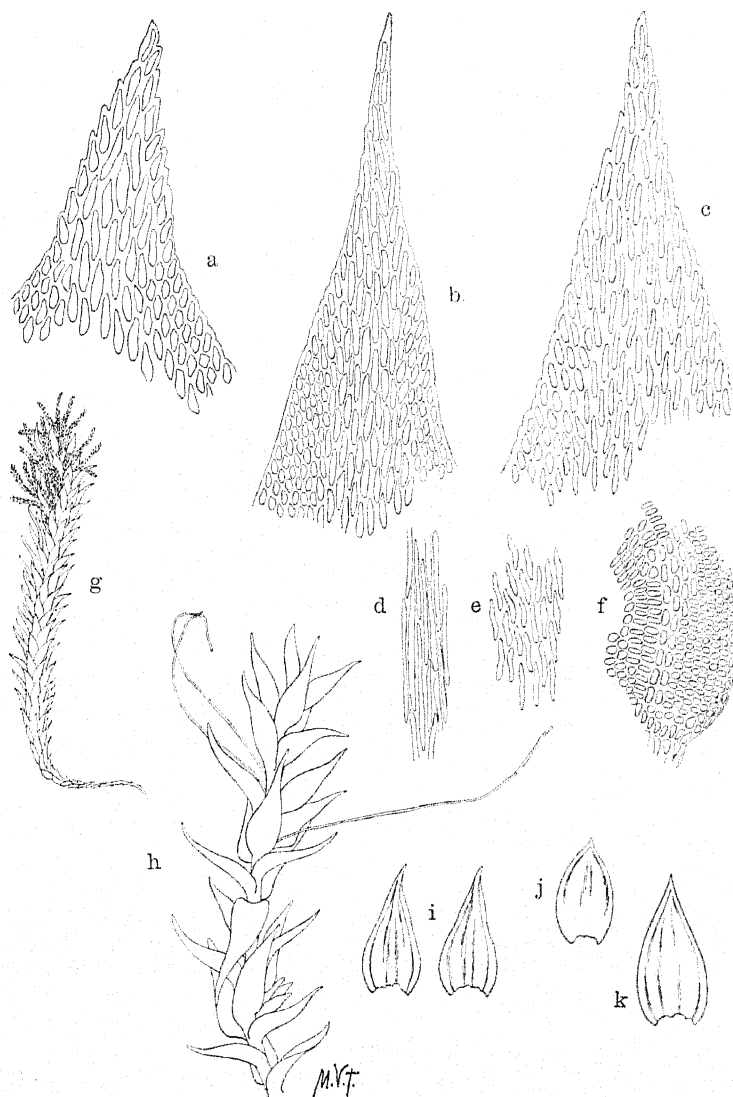


FIGURE 212. a, b, c. Apices of leaves of *Leucodon julaceus*, *L. sciuroroides* and *L. brachypus* respectively $\times 250$. d, e, f. Upper-median, median-basal, and aar cells respectively of *L. brachypus* $\times 250$. g. Secondary stem of *L. sciuroroides* having flagella $\times 3$. h. Flagellum of *L. sciuroroides* $\times 50$. i. Leaves of *L. sciuroroides* $\times 10$. j. Leaf of *L. julaceus* $\times 10$. k. Leaf of *L. brachypus* $\times 10$.

Calyptra cucullate, smooth, often attached below the capsule by the connate base; capsules exserted or emergent, erect and symmetric; peristome apparently simple; teeth 16, articulate and papillose, bifid or occasionally trifid; inner peristome reduced to a narrow inconspicuous membrane. We have three species, only one of which, *L. sciuroides*, is European.

KEY

1. Leaves ovate-elliptical, abruptly short-acuminate *julaceus*.
 Leaves ovate to ovate-lanceolate, gradually longer-acuminate 2.
2. Seta much shorter than perichaetial leaves; secondary stems well-developed, rarely flagellate *brachypus*.
 Seta longer than perichaetial leaves; secondary stems less developed, often bearing numerous flagella *sciuroides*.

L. julaceus (Hedw.) Sulliv. This species is typically southern, extending north to southern New England and corresponding latitudes of the eastern United States. The secondary stems are typically shorter than in the other two species, the branches very terete, julaceous when dry; the leaves closely appressed and imbricate, not at all secund, ovate-elliptical, abruptly short-acuminate, very concave, scarcely plicate, serrulate at apex; upper median leaf cells markedly shorter and broader than in the other two species: capsule long-exserted as in *L. sciuroides*; annulus none; teeth bifid at apex. Easily recognized by its perfectly terete stems and smaller, scarcely plicate, abruptly acuminate leaves.

L. sciuroides (L.) Schwaegr. Forming tufts or mats of brownish green, lighter green at the tips of the secondary stems, which are terete and julaceous, more or less drooping and curved upwards at the ends, rarely 5cm long, usually not over 3cm, frequently producing such a great number of flagelliform small-leaved branches as to cause the plant to appear deformed; leaves of secondary stems slightly secund, ovate-lanceolate, somewhat decurrent, long and slenderly acuminate, entire, plicate with several folds: seta about 8mm long; capsule exserted; annulus present; teeth entire or split toward the base. Very rarely fruiting.

Easily distinguished from *L. julaceus* by the different shape of its leaves. It fruits so rarely that it has to be differentiated from *L. brachypus*, which it closely resembles, by its leaf apices. The acumination of the leaves is longer and more slender than that of *L. brachypus* and is also entire. The upper median cells are also usually a little more elongated. The secondary stems also are much shorter than those of well-developed *L. brachypus*. Probably common in northeastern United States and eastern Canada, but not often collected or else confused with *L. brachypus*. Collectors should be on the lookout for it. In examining leaves for serration, several should be examined, as the leaves of *L. brachypus* and *L. julaceus* are sometimes nearly entire.

L. brachypus Brid. Secondary stems averaging longer and larger than in the preceding species, less frequently branched; leaves more strongly secund, plicate but with fewer folds than in *L. sciuroides*; the acumination is serrulate and not nearly so slender and pointed as in *L. sciuroides*; seta 3-4^{mm} long, wrapped up in the perichætal leaves, which over-top the emergent capsule; annulus lacking; teeth bifid at apex; spores in winter.

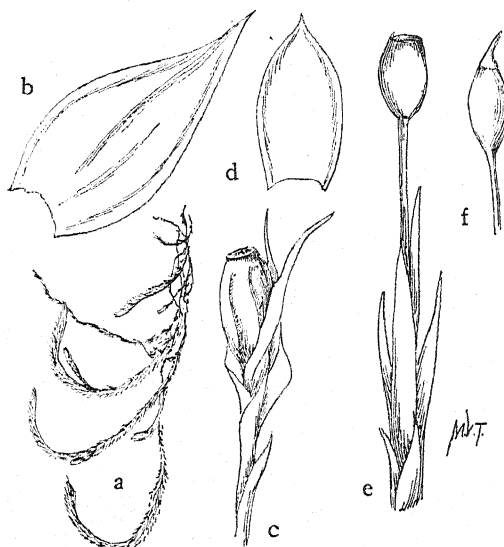


FIGURE 213. a. Plant of *Leucodon brachypus* $\times 20$. b. Leaf of *L. brachypus* $\times 10$. c. Sporophyte of *L. brachypus* $\times 10$. d. Leaf of *L. julaceus* $\times 20$. e. Sporophyte of *L. julaceus* $\times 10$. f. Capsule of *L. julaceus* $\times 10$.

Has about the same ranges as the last, but extends farther south. Abundant and frequently fruiting in the mountain regions of northeastern United States. It extends to Georgia along the mountains. A form from Stone Mountain, Georgia (J. K. Small), is much more slender than the usual northern form.

FORSSTRØEMIA Lindb.

(*Leptodon* of L. & J. Manual)

Much like *Leucodon*, but distinguished in all our species by the abundant branching of the secondary stems and by the hairy calyptra. Many species have strongly costate leaves and most are less glossy than *Leucodon*.

F. trichomitria (Hedw.) Lindb. is the only species at all frequent within our range. Its leaves are difficult to distinguish microscopically from those of *Leucodon brachypus* or *L. sciuroides*, but the duller color, subpinnate branching and more loosely imbricated leaves will usually enable one to recognize it in the field; spores in winter. Other structural details are shown in plate 86. Rather infrequent and local.

Var. *immersa* (Sulliv.) Lindb. is a common southern form which may possibly be found in the southern part of our range. The leaves sometimes show traces of a costa and the capsules are immersed in the perichætal leaves.

F. Ohioensis (Sulliv.) Lindb. is a rare species of the Central States, more slender than the last; costa reaching the middle of the leaves and seta plainly longer than the perichætal leaves.

Cryphaea glomerata B. & S., a common plant of the southern states, though more slender than any of the species of this family mentioned above, has a similar leaf structure and might be sought here. The leaves are costate and the costa of the inner perichætal leaves is excurrent: capsules immersed; seta hardly perceptible; annulus large; peristome double. On trees.

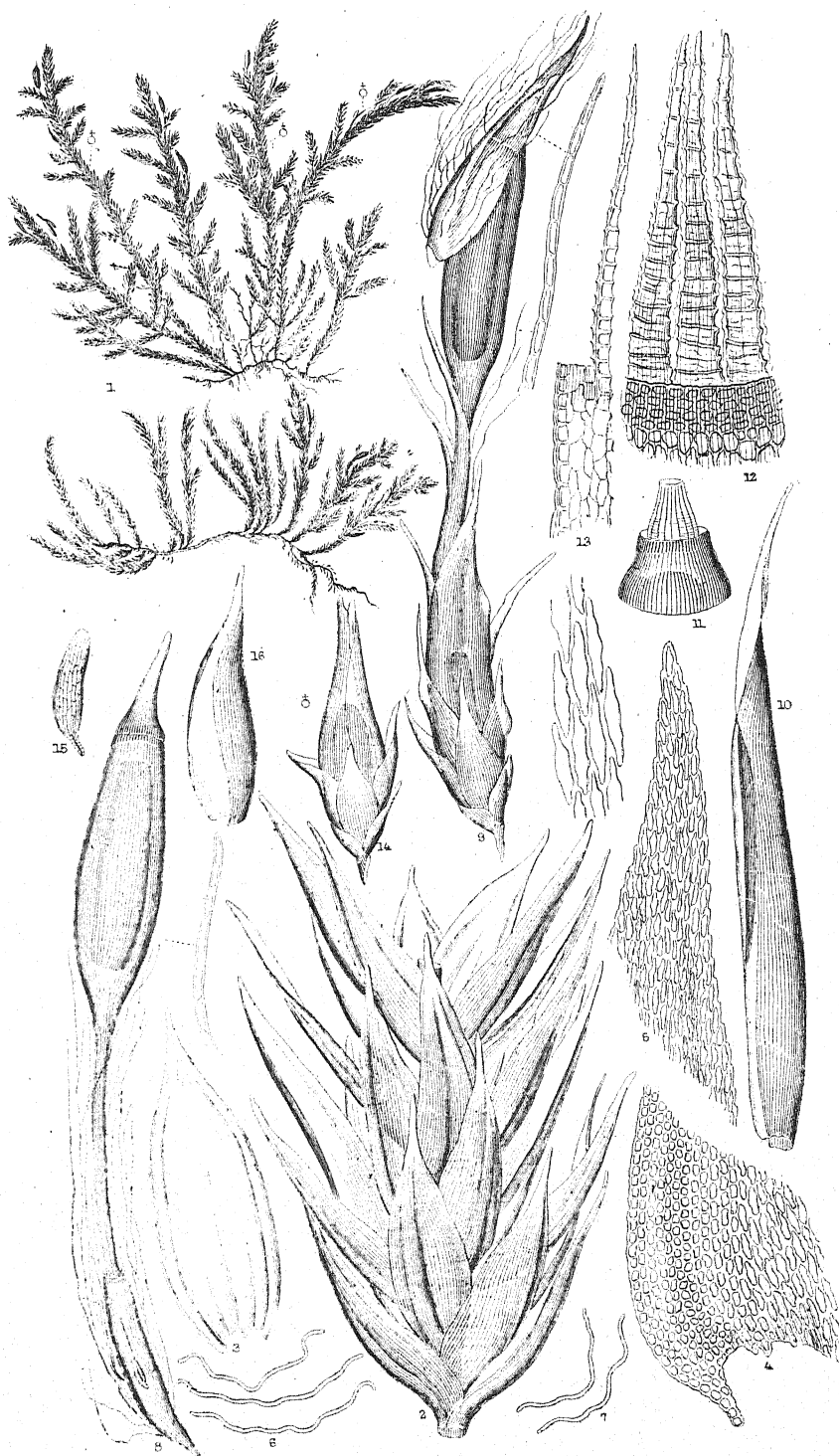
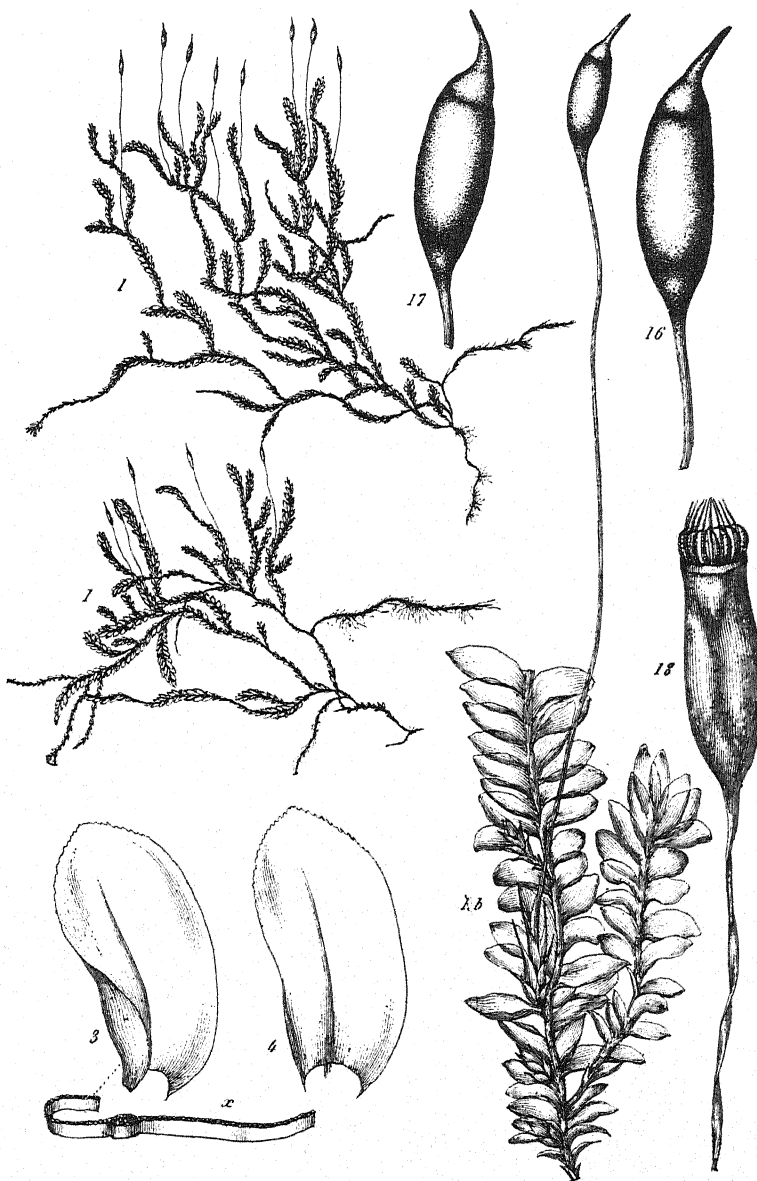


PLATE LXXXVI. *Forsstræmia trichomitria* (From Sulliv. "Icones")

Family 25. Neckeraceae

Mostly growing on rocks and trees. Primary stems creeping and defoliate; secondary stems erect, horizontal, or pendent, irregularly to pinnately branching;

leaves large, ovate-lanceolate to lingulate or cultriform, acute, obtuse or apiculate, ecostate or with a slender costa; leaf cells not papillose, short, rhombic to linear, quadrate to roundish on the margins. Calyptra smooth or hairy; capsule erect and symmetric, immersed or emergent, rarely with seta longer than perichætium; peristome single or double.



KEY TO GENERA

Leaves cultriform, costate in our species . . . *Homalia*.
Leaves ecostate . . . *Neckera*.

HOMALIA (Brid.)
B. & S.

Leaves costate and capsule long-exserted.

H. Jamesii Schimp. Very loosely tufted, often straggling, shining yellow-green; branches very strongly complanate-foliate; leaves cultriform, minutely serrulate above the middle; costa faint, reaching half way or more; lower median leaf cells linear-fusiform; apical and marginal broadly rhomboidal, as broad as long;

FIGURE 214. *Homalia trichomanoides*. (Schreb.) B. & S.
(From Bry. Eur.)

monoicous; capsules exserted on a fairly long seta; peristome double; *segments narrow, as long as teeth or longer*; cilia rudimentary or none; annulus present; spores in autumn, rather infrequently produced. Our plant is very close to the European *H. trichomanoides*, differing in minor character only, so that the figure of that species answers equally well for our own *Jamesii*. *H. Macounii* C.M. is in all probability a synonym of *H. Jamesii*.

This species is an extremely pretty moss and is frequent on moist rocks in the mountains. By reason of its strongly flattened branches it resembles a *Fissidens* or an hepatic, but a microscopical examination will readily show the difference. It often grows on the underside of overhanging rocks in cool moist ravines; here it is often found in single strands, producing a very pretty effect.

NECKERA Hedw.

Plants usually large (excl. *gracilis*), growing on trunks of trees or rocks; primary stems creeping, often stoloniferous; secondary stems erect to pendent, often pinnately branched, usually complanate-foliate; stems and branches sometimes flagelliform; leaves often transversely undulate, ovate-lanceolate to oblong or lingulate, frequently unsymmetric, ecostate or nearly so; leaf cells broadly rhomboidal at apex and upper margins, changing to linear-oblong or linear-flexuose at base; capsules immersed or exserted; peristome double, the inner a short membrane with short segments or with segments longer and narrowly linear, cilia wanting; annulus lacking.

KEY

1. Leaves ovate-lanceolate, undulate, acute *pennata*.
 Leaves oblong, not undulate, rounded at apex, often apiculate 2.
2. Plants nearly or quite as stout as in *pennata* *complanata*.
 Plants filiform *gracilis*.

N. pennata (L.) Hedw. Plants large; secondary stems 7-10^{cm} in length; branches obtuse or rarely attenuate; leaves ovate-lanceolate, acute to acuminate, strongly undulate, entire or slightly denticulate above; costa short and faint; capsules abundant, immersed; teeth of peristome often united at tips and more or less irregularly divided; segments short and imperfect as figured under var. *oligocarpa*; spores in summer.

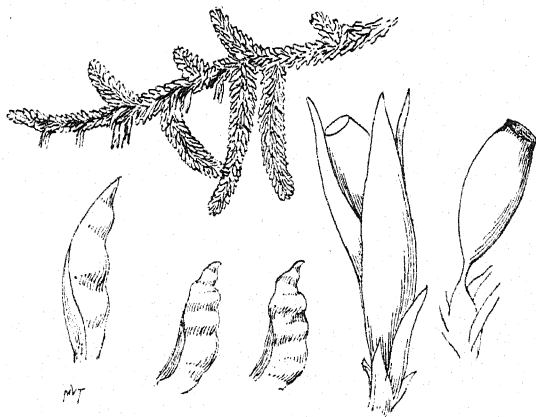
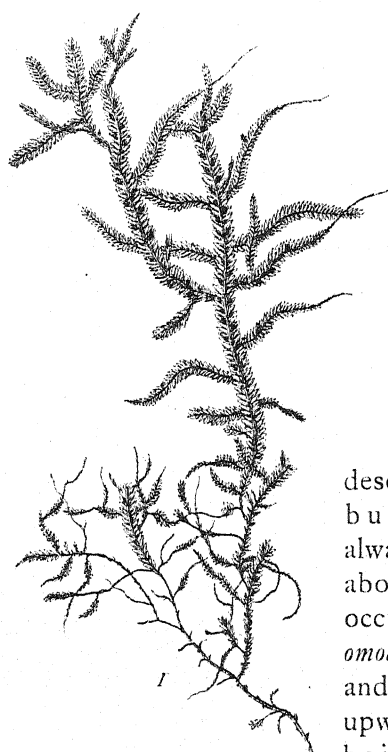


FIGURE 215. *Neckera pennata* $\times 1$; leaves $\times 10$; capsules, with and without perichaetial leaves $\times 10$.

FIGURE 216. *Neckera pennata oligocarpa* (From Bry. Eur.)

This species is found almost exclusively on the trunks of deciduous trees in cool moist woods. It is rarely found on ledges or cliffs. It is a common plant in the habitat

described above, rarely growing near the base of a tree, but nearly always growing above the region occupied by *Anomodon* or *Leskea* and extending upward to a height of

from 25-50 feet according to the height of the trees and the density of the woods. This species is easily recognized by its flattened branches, wavy leaves, and immersed capsules.

Var. *oligocarpa* (Bruch). Plants smaller with branches attenuate to flagelliform as figured: capsules like the species. Rare; found in cool shaded places, usually in mountains.

N. complanata (L.) Hueb. is a rare subalpine species, rarely, if ever, fruiting in America. The oblong leaves not undulate, and rounded at apex and apiculate, distinguish it at once from *pennata*. The capsules when produced are

FIGURE 217. *Neckera complanata* (From Bry. Eur.)

long exserted as figured. The branches are often flagellate and the branch leaves are often narrower than the leaves figured.

N. gracilis (James) Kindb. (*Homalia gracilis*, James) is a very rare moss growing on cool shaded rocks. It is almost *filiform*, *freely and irregularly branching*; stems and branches flagellate; the best developed leaves are oblong to cultriform, rounded at apex and more or less apiculate; leaf cells *much shorter than in our other species* of *Neckera*, the lower median being oblong-hexagonal to rhomboidal, 2-5:0.

Family 26. Fontinalaceae. Water Mosses

Aquatic, floating, usually slender, *attached at base of stems only*, often very long, dark to blackish green, especially below. Central strand lacking in the stems. Leaves ecostate in *Fontinalis*, costate in *Dichelyma*, mostly decurrent, entire or slightly denticulate at apex; leaf cells rhomboid-hexagonal to linear-flexuose, broader and shorter at base of leaf and often at apex also. Seta short; *capsule immersed in the perichaetial leaves or shortly exserted, without neck or stomata*; annulus lacking; peristome double, the outer composed of 16 teeth, *the inner of 16 linear divisions more or less completely united by cross strands at regular intervals, forming a regular net* or trellis through the meshes of which the spores gradually escape.

Although mosses belonging to several other families are aquatic, the mosses of this family are most emphatically entitled to the name of Water Mosses, as the members of the family are either submerged all the time or attached to objects that are submerged at high water.

KEY TO THE GENERA

- | | |
|---|---------------------|
| Costa lacking, leaves mostly symmetric | <i>Fontinalis</i> . |
| Costa present, leaves mostly falcate-secund | <i>Dichelyma</i> . |

FONTINALIS Dill.

Stems usually *denuded of leaves below, long slender and floating*, freely branched, usually blackish green, except the latest growth; *leaves ecostate*, sometimes nearly flat, but usually strongly concave to nearly tubular. (The young undeveloped leaves at the ends of the shoots are always convolute.) Median leaf cells linear, often long and narrow; alar cells subrectangular to subhexagonal, forming more or less distinct auricles. Dioicous; capsules *sessile, little exceeding the perichaetial leaves*; outer peristome teeth long, sometimes united at apex.

All our species are submerged, some grow attached to stones and sticks in swift brooks, others in ponds and sluggish streams. Rarely, if ever, are they found in stagnant water. By reason of the peculiarities named the genus is

easy to recognize, but the species are often difficult or impossible to distinguish without authentic specimens for comparison as there is relatively very little difference in the areolation of the leaves. I have treated somewhat in detail our five most common species, but we undoubtedly have within our range as many more generally recognized species, but these are either rare or very difficult to distinguish. Some of these rarer species I have treated by comparing with the common species which they most strongly resemble and with which they are most likely to be confused.

I have used to a very great extent the monograph of the family by M. Jules Cardot and hereby acknowledge my indebtedness to him, although I must confess that his eyesight for specific distinctions seems to be considerably more acute than mine. The difficulty of identifying sterile and poorly developed forms is emphasized by the fact that all the older American exsiccati are badly mixed.

KEY

1. Plants very large, leafy stems triangular, 5-7^{mm} in diameter; leaves keeled *gigantea*.
Plants much smaller, not evidently three-cornered, leaves concave but not keeled 2.
2. Plants very slender and rather rigid; leaves oblong-lanceolate to narrowly lanceolate. . . . 3.
Plants much stouter; leaves broader, oblong-lanceolate to ovate 4.
3. Stem and branch leaves markedly different; stem leaves 4-6^{mm} long, very long and slenderly acuminate *Sullivantii*.
Stem and branch leaves little different, 2-3^{mm} long, much less slenderly acuminate. *dalecarlica*.
4. Leaves distant, loosely erect-spreading, usually plane or slightly concave above, somewhat acuminate, acute or somewhat obtuse, soft *Lescurii*.
Leaves less spreading, closer, concave and often cucullate above, less slenderly acuminate, more broadly obtuse, more rigid *Novæ-Angliæ*.

F. gigantea Sulliv. is very common in cool brooks in most places. It is most distinct by reason of its large turgid three-cornered stems and branches, which sometimes reach 3^{dm} in length. The deeply concave and keeled leaves reach 8^{mm} in length; median cells 6-15:1; alar subrectangular, somewhat inflated; for peristome, see Plate V, Fig. 17; spores in summer. (See Plate LXXXVIII.)

F. Lescurii Sulliv. Plants soft and loose; stems 3-4^{dm} long, much denuded at the black base; leaves distant, erect and open or loosely imbricated, soft, concave and clasping at base, usually plane above, rather slenderly acuminate for the genus, ovate-lanceolate to oblong-lanceolate, acute or subobtuse, usually a little denticulate at the apex, 3.5-7^{mm} long; median cells 12-15:1, the upper shorter; alar enlarged, oblong, inflated, forming distinct auricles: upper perichætil leaves broadly ovate, rounded obtuse, longer than the capsule before maturity; peristome teeth reddish orange, of 20-28 lamellæ, papillose; trellis of inner peristome imperfect, slightly appendiculate. Not rare in cool brooks and ponds, but less frequent than the other species described, except *Sullivantii*. South in the mountains to Alabama. Often difficult to distinguish from the



PLATE LXXXVII. *Fontinalis Lescurii* (From Sulliv. "Icones")

next, from which it differs chiefly in the softer, less concave leaves, more slenderly acuminate and less obtuse, and in the more papillose peristome teeth with more (20-28) lamellæ.

F. Novæ-Angliæ Sulliv. Plants firmer than in the last, of about the same size, leaves rather closer, more closely imbricated, ovate-lanceolate to oblong-lanceolate, concave and usually with borders inflexed, often cucullate at apex, usually rounded-obtuse but sometimes subobtuse or apiculate, usually denticulate at apex only, 2.5-4^{mm} long; median cells 8-20:1, alar inflated, oblong, subhyaline or colored: upper perichæatial leaves ovate-suborbicular; peristome teeth "purple," with 18-20 lamellæ, slightly papillose; trellis imperfect, the cilia united at the summit only; spores smooth. Common in brooks throughout, probably our most common species.

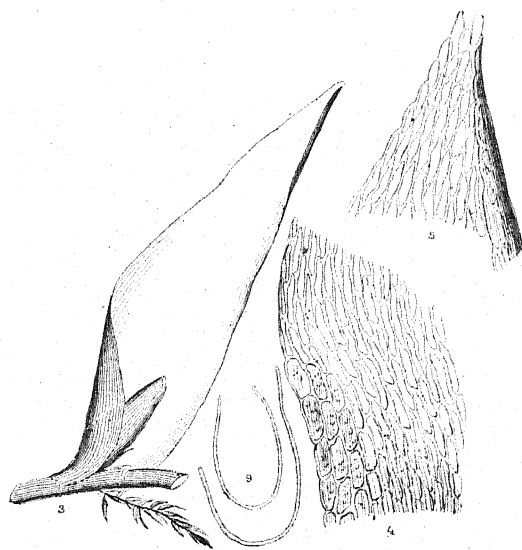


FIGURE 217. *Fontinalis Novæ-Angliæ*
(From Sulliv. "Icones")



FIGURE 218. *Fontinalis dalecarlica*
(From Bry. Eur.)

F. Cardoti Ren. is a recently described species of wide distribution and it may prove fairly common. It is closely allied to *Novæ-Angliæ*, from which it differs in being considerably larger and more densely foliate; leaves imbricated, with thicker cell walls; perichæatial leaves entire, not lacerate when old; operculum longer; peristome teeth more papillose with fewer lamellæ (13-16); spores brownish and finely muriculate.

F. dalecárlica B. & S. Stems 1-4^{dm} long, much subdivided and branched, slender, attenuate at the ends; leaves rather close, erect-open to loosely imbricate, oblong-lanceolate to narrowly lanceolate, more or less long-acuminate, acute or narrowly obtuse, entire or subdenticulate at apex, concave with margins

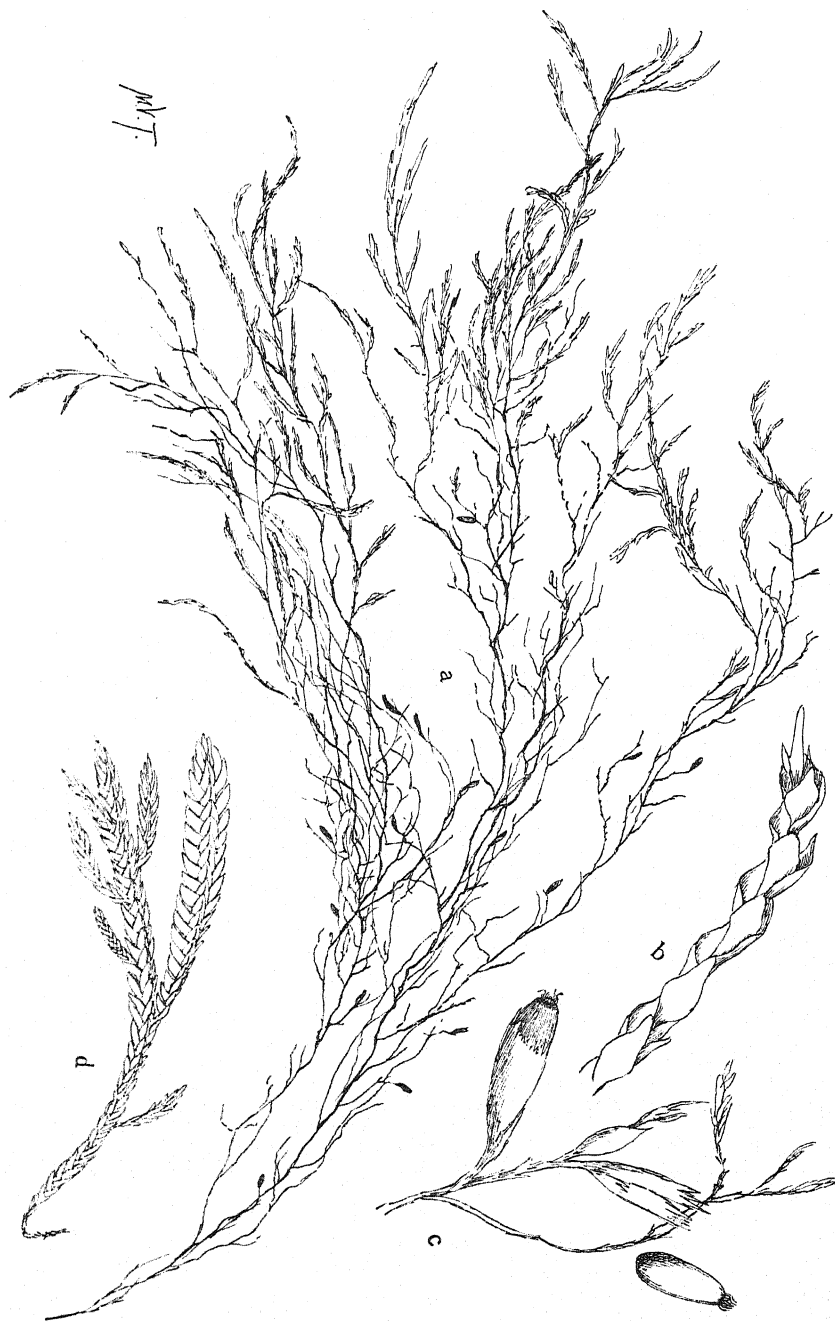


PLATE LXXXVIII. a. *Fontinalis dalecarlica* $\times \frac{1}{2}$. b. Branch of *F. Nova-Angliae* $\times 5$. c. Portion of same bearing capsules $\times 5$. d. A short branch of *F. gigantea* $\times 1$

rolled inwards, 2-3^{mm} long; median cells narrow, attenuate, 15-20:1; alar cells somewhat inflated, subrectangular to subhexagonal: upper perichæatial leaves usually somewhat narrowed at apex, apiculate, finally strongly lacerate; peristome reddish orange, sometimes brownish; teeth granulose with 15-22 lamellæ; trellis imperfect; spores in summer, lightly muriculate. Common. Easily distinguished from all our other common species by its slender habit and narrow leaves. It is often found growing intertangled with *F. Novæ-Angliæ*.

F. Sullivantii Lindb. (*F. Lescurii* var. *gracilescens* Sulliv., non var. *ramosior* Sulliv.) Very slender, regularly pinnate with distant attenuate branches; leaves very distant; stem leaves soft, somewhat concave, lanceolate, and narrowly long-acuminate, acute or subobtusate, entire or slightly denticulate, 4-6^{mm} long; branch leaves much smaller, 2-3^{mm} long, more rigid, concave, canaliculate, acuminate: operculum conic, long-acuminate; peristome teeth lightly papillose; spores very finely muriculate. Not common. Apparently more frequent near the coast than inland. All specimens referred to *F. disticha* Hook. & Wilson from our range belong to this species so far as is known to M. Cardot.

F. bifórmis Sulliv. is a rare but very interesting moss. The leaves are of two kinds, the so-called "vernal" leaves, which are so nearly like those of *F. Lescurii* and *F. Novæ-Angliæ* as to be confused with them by some of the best bryologists; and the so-called "summer" leaves which are much smaller and narrower, convolute and tubulose above, the inrolled edges overlapping. When fresh and floating the "summer" leaves often appear plainly three-ranked and are quite widely spreading. This form is easy to recognize. The "vernal" leaves are probably the leaves of young plants or shoots and the others the leaves of adult plants. Widely spread; New Hampshire, British Columbia, Florida, but often incorrectly reported.

DICHELYMA Myr.

Plants growing near the edge or surface of the water, generally submerged at high water, shorter than *Fontinalis* with the appearance of *Drepanocladus*; leaves three-ranked, costate, narrowly lanceolate, second to falcate-second; leaf cells narrow, linear; basal shorter, brownish, not forming auricles. Dioicous; perichætium very long, cylindric, the leaves convolute, very long, spirally twisted, ecostate; seta of moderate length enclosed by the perichætial leaves, sometimes longer and sometimes shorter than the perichætium; peristome much as in *Fontinalis*, but the teeth shorter than the inner peristome.

KEY

1. Costa long-excurrent *capillaceum*.
- Costa subpercurrent to shortly excurrent 2.
2. Capsule extending beyond the perichætium; trellis of inner peristome perfect . . . *falcatum*.
- Perichætium exceeding capsule and seta in length; divisions of inner peristome free or united at summit only *pallenscens*.

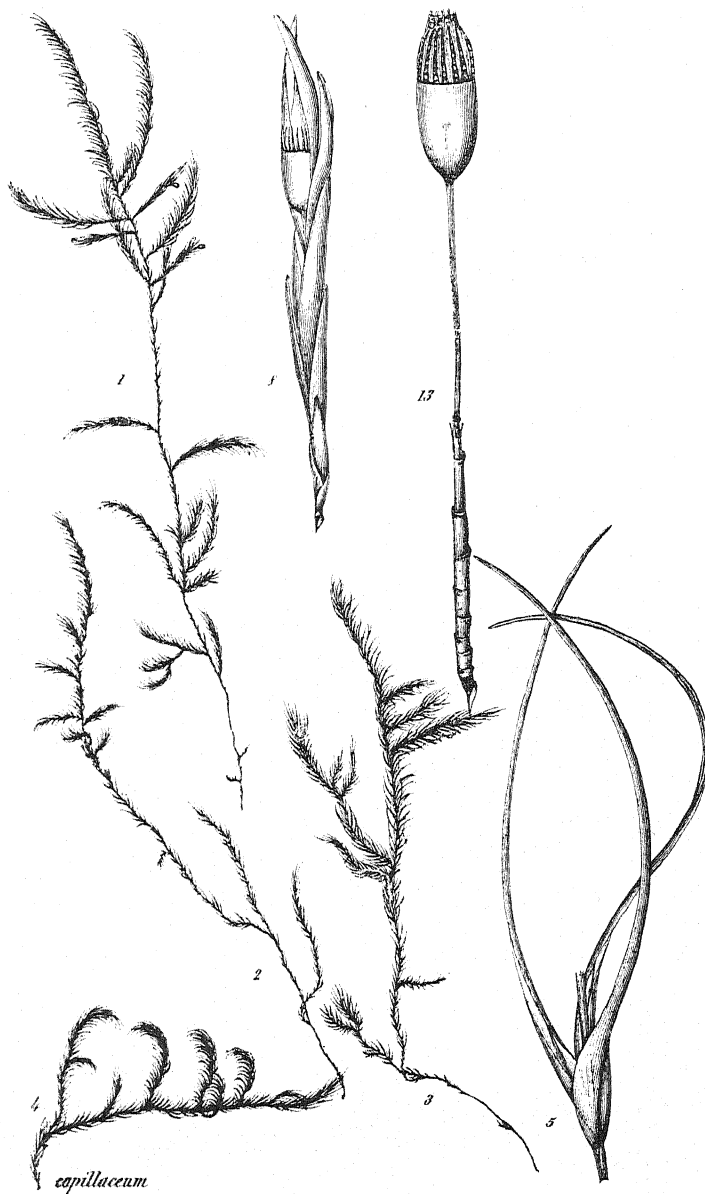


FIGURE 219. *Dichelyma capillaceum* (From Bry. Eur.)

D. capillaceum B. & S. Our only common species. Plants yellowish or brownish above, blackish below; stems slender, 5-15cm long; leaves erect-spreading, second to falcate-second, *long-linear from a lanceolate base*, 5-7mm long; usually denticulate above; *costa long excurrent*; spores in late summer. Attached to bushes and other objects in shallow water, especially in swamps.

D. palléscens B. & S. Plants lighter in color, sometimes yellowish and glossy, slender; leaves secund and more or less falcate, hooked at the ends of stems and branches, oblong-lanceolate, gradually long-acuminate, acute to somewhat obtuse, 3-4^{mm} long, denticulate above with few exceptions; costa percurrent or

disappearing below the apex; perichætium longer than seta and capsule; peristome teeth poorly developed, linear; divisions of inner peristome free or united at summit only; spores in summer. In situations similar to those occupied by the last, but much less frequent.

D. falcätum Myrin. Yellowish and glossy above, usually blackish at base, *having the habit and appearance of Drepanocladus*; leaves strongly falcate-secund, close, imbricate at base, oblong-lanceolate, then gradually narrowed and subulate-acuminate, 3-5^{mm} long, denticulate above; costa excurrent or disappearing in the

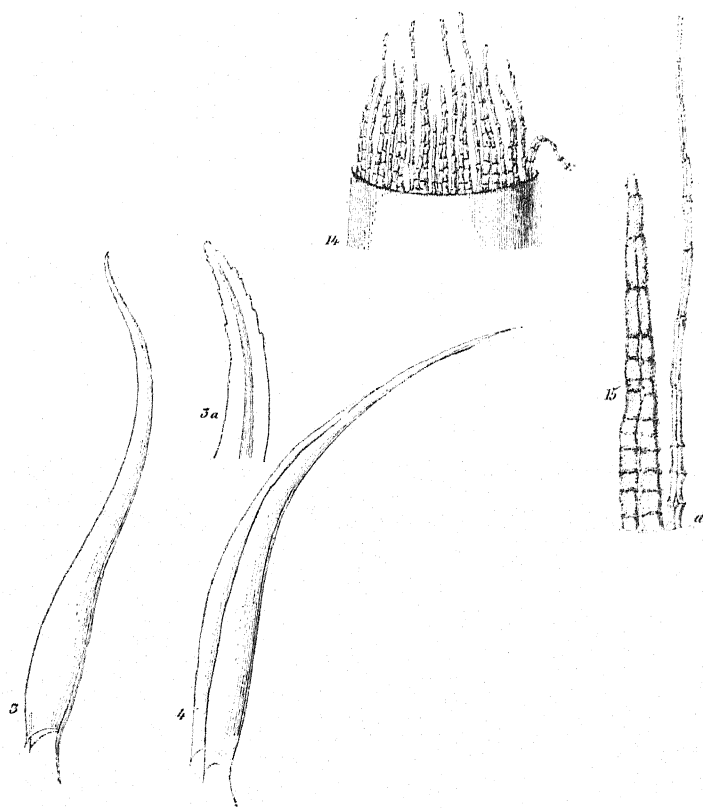


FIGURE 220. *Dichelyma pallescens* (From Bry. Eur.)

apex; seta usually markedly longer than the perichætium; operculum as long as urn, obliquely beaked; peristome teeth strongly papillose, *trellis perfect*, longer than the teeth. A rather rare species of mountain brooks.

Sterile plants are easily distinguished from *Drepanocladus* by the lack of inflated alar cells. From the last species it may be known by its larger size and leaves more strongly falcate-secund throughout and more slenderly acuminate.

NOTE that the arrangement of families after the *Hypnaceæ* is different from that found on page 7. The *Pterygophyllaceæ* are omitted entirely as there is only one rare species, *Hookeria Sullivantii* C. M., that may possibly be found within our range.

KEY TO STERILE SPECIMENS

This key is not prepared with the idea that it will enable any one to identify every moss with absolute certainty, but with the idea that it may help the student in placing sterile specimens of special interest. I believe a key to sterile mosses that will enable a novice, no matter how intelligent, to name any considerable number of sterile mosses without other assistance is an impossibility.

Whenever it has been possible to trace out an entire family to one point the key has stopped there, as the keys to genera and species are based on gametophyte characters as far as possible.

- a. Plants whitish or light gray, scarcely appearing green . . . b.
Plants green, yellow-green, or dark green to almost black . . . c.
- b. Plants of bogs; leaves of large colorless cells surrounded
by narrow green cells . . . *Sphagnum*.
Plants showing but one kind of leaf cells (except in section). *Leucobryum*.
- c. Leaves in two rows with edges apparently toward the stem. d.
Leaves in more than two rows or if apparently two-ranked
the edges of the leaf are not toward the stem . . . e.
- d. Leaves apparently split on the inner edge and sheathing
each other and the stem, costate . . . *Fissidentaceæ*.
Leaves ecostate, not split at base but forming a continuous
wing margin on stem in sterile plants . . . *Schistostega*.
- e. Acrocarpous. (See glossary. There is usually little difficulty
in determining this fact even in sterile specimens.) . . . f.
Pleurocarpous . . . F.
- f. Plants black or blackish green, except at tip of growing
stems and branches; leaves with very thick cell walls;
growing on rocks and trees . . . g.
Plants green to light yellow-green, sometimes hoary, or, if
blackish, growing on the ground . . . C.
- g. Leaves ecostate . . . h.
Leaves costate . . . i.
- h. Leaves obtuse, never with hyaline apices . . . *Andreaea petrophila*.
Leaves acute, mostly with hyaline apices . . . *Hedwigia*.
- i. Growing on rocks . . . A.
Growing on trees . . . B.

A

- 1. Leaves with a hyaline apex . . . 2.
Leaves without hyaline apex . . . 3.
- 2. Basal leaf cells narrowly linear-sinuose, thick-walled . . . *Racomitrium*.
Basal leaf cells not sinuose, thinner-walled than the upper.
(excl. *Grimmia Pennsylvanica* and *G. apocarpa*.) . . . *Grimmia*.
- 3. Basal leaf cells narrowly sinuose and nodulose . . . *Racomitrium* and *Andreaea Rothii*.
Basal leaf cells not as above . . . 4.

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4. Leaves crispate when dry *Amphidium* and *Ptycomitrium*.
Leaves not crispate when dry 5.
5. Plants almost black throughout, very brittle; almost exclusively alpine or subalpine *Andreaea*.
Plants green at tips, less brittle, many species common at low and medium altitudes 6.
6. Leaves papillose *Ulota Americana* and *Orthotrichum*.
Leaves not papillose (papillose in a few species) *Grimmia*.

B

1. Leaves crispate when dry *Ulota*.
Leaves not crispate but closely imbricate when dry 2.
2. Plants in wide spreading mats with a pleurocarpous habit . . . *Drummondia*.
Plants erect, usually in smaller rounded tufts *Orthotrichum*.

C

1. Leaves with numerous lamellæ on inner surface of costa (inconspicuous in *Catharinea crispa*) 2.
Leaves without lamellæ on inner surface of costa 3.
2. Plants very small; rare; leaves ovate *Pterygoneuron*.
Plants large, common; leaves lanceolate *Polytrichaceæ*.
3. Stalked receptacles bearing gemmæ nearly always present . 4.
Plants without gemmæ or producing them on stems and leaves 5.
4. Gemmæ in terminal leafy cups *Georgia*.
Gemmæ in rounded heads on stalks *Aulacomnium*.
5. Plants minute, mostly annual, almost microscopic *Ephemeraceæ* and *Phascum*.
Plants larger, easily seen without a lens 6.
6. Leaf cells papillose D.
Leaf cells not papillose E.

D.

1. Leaves strongly contorted to crispate when dry. (*Bartramia* species may be sought here) 2.
Leaves little or not at all contorted when dry 6.
2. Plants small, less than 1^{cm}
Weisia, *Webera*, *Barbula*, *Rhabdoweisia* and *Desmatodon*.
Plants of medium size (1-3^{cm}) or larger 3.
3. Leaves spatulate to lingulate; costa often excurrent
Tortuleæ, *Didymodon tophaceus* and *Encalypta*.
Leaves obtusely acuminate to slenderly long-acuminate . . 4.
4. Alar cells distinctly enlarged and inflated
Dicranum spurium, *D. pallidum* and *D. montanum*.
Alar cells as well as basal often somewhat larger and hyaline but not distinctly inflated 5.
5. Leaves entire or merely denticulate above
Oncophorus and *Tortulaceæ* (in part.)
Leaves strongly serrate *Timmia*.

KEY TO STERILE SPECIMENS

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6. Leaves plainly two-ranked (Fig. 34) *Swartzia*.
Leaves not two-ranked 7.
 7. Leaves obtuse, broadly ovate to oblong-ovate *Aulacomnium*.
Leaves acute to acuminate 8.
 8. Papillæ not on faces of cells but formed by projecting angles
of cell walls *Bartramiaceæ*.
Papillæ on surface of cells 9.
 9. Leaves squarrose-recurved, strongly serrate *Paludella*.
Leaves erect, entire except at apex *Ceratodon*.
- E
1. Alar cells plainly inflated, often colored
Blindia, Dicranum, Dicranodontium and Campylopus.
Alar cells not distinctly inflated, but sometimes larger and
hyaline 2.
 2. Leaves bordered, at least in the lower half, by a margin of
narrow elongated cells 3.
Leaves not bordered 4.
Leaves indistinctly bordered *Rhodobryum and Mnium cinclidioides*.
 3. Leaves broader; leaf cells nearly as broad as long *Mnium*.
Leaves narrower; leaf cells more elongated *Bryum, Mniobryum*.
 4. Upper leaf cells 20 μ or more in diameter 5.
Upper leaf cells small or narrower, rarely over 15 μ wide . . 10.
 5. Leaf cells short, quadrate or rounded 6.
Leaf cells elongated 7.
 6. Costa excurrent *Pottia*.
Costa ending below apex *Mnium stellare*.
 7. Leaf cells mostly with pointed ends 8.
Leaf cells flattened at the ends (or leaves large, wide and
flaccid) *Splachnaceæ, Funariaceæ*.
 8. Leaves closely imbricate, green or pinkish *Plagiobryum*.
Leaves closely imbricate and silvery white *Bryum argenteum*.
Leaves scarcely imbricate 9.
 9. Leaves usually narrow, costa not reaching apex *Poblia, Mniobryum albicans*.
Leaves usually narrow, costa often reaching apex or ex-
current *Bryum*.
Leaves hair-like, costa long-excurrent *Leptobryum*.
 10. Leaves short, glaucous, mealy looking *Selania*.
Leaves not glaucous 11.
 11. Leaves obtuse, rounded or somewhat apiculate 12.
Leaves acute to slenderly acuminate 13.
 12. Leaves serrate *Meesea and Aulacomnium species*.
Leaves entire *Meesea species*.
 13. Plants minute, rarely collected unless fruiting 14.
Plants of medium size (1-3 cm) or larger 15.
 14. Alpine or subalpine; rare *Brachyodus, Seligeria, Rhabdoweisia*.
Plants of lower altitudes of frequent occurrence
Bruchia, Pleuridium and Dicranella species.

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15. Leaves secund *Dicranella, Ditrichum.*
Leaves rarely secund 16.
16. Leaves squarrose-spreading *Meesea, Dicranella Schreberi.*
Leaves not squarrose-spreading 17.
17. Leaves entire or nearly so
Ditrichum, Didymodon, Trematodon, Dicranella.
Leaves serrate
Ditrichum, Dicranella, Bartramia Ederi, Timmia.

F. Pleurocarpi

1. Leaves papillose by reason of projections from the cell surface .
Leskeaceæ (one or more exceptions).
Leaves not papillose, or rarely papillose by reason of the projection of the angles of the cell walls 2.
2. Leaves ecostate or with costa short and inconspicuous 3.
Costa well developed, usually single, sometimes double or forking 12.
3. Leaf cells from lower median region 1-5:1 4.
Leaf cells 5-20:1 6.
4. Complanate-foliate *Neckeraceæ.*
Not complanate-foliate 5.
5. Leaf cells thick-walled *Leucodontaceæ, Habrodon.*
Leaf cells thinner-walled *Amblystegiella, Leskea denticulata.*
6. Aquatic, long and floating *Fontinalis.*
Not aquatic or, if aquatic, not long and floating 7.
7. Leaves squarrose-recurved
Campylium, Hylocomium species, *Plagiothecium striatellum*
Leaves not squarrose-recurved 8.
8. Strongly complanate-foliate
Plagiothecium, Entodon, Hypnum pratense.
Not complanate 9.
9. Aquatic
Hygrohypnum, Raphidostegium, Scorpidium.
Not aquatic 10.
10. Regularly pinnate and plumose *Hypnum, Hylocomium.*
Not regularly pinnate and plumose 11.
11. Growing on trunks of trees
Pylaisia, Platygyrium, Raphidostegium, Hypnum.
Not growing on trees
Calliergon, Hypnum, Raphidostegium, Plagiothecium, Entodon seductrix.
12. Median leaf cells 1-5:1 13.
Median leaf cells 5-20:1 18.
13. Large plants with dendroid habit
Climacium (excl. forms of *C. Kindbergii*), *Porotrichum.*
Smaller plants, not dendroid 14.
14. Growing on trunks of trees 16.
Growing on soil, stones or decaying wood 15.

KEY TO STERILE SPECIMENS

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15. Leaves squarrose-spreading in most species *Campylium*.
Leaves complanate *Homalia*.
Leaves not squarrose-spreading or complanate
Amblystegium, Bryhnia, Brachythecium reflexum.
16. Very small or very slender or both *Fabroniaceæ, Cryphæa*.
Plants of medium size 17.
17. Complanate-foliate *Homalia*.
Not complanate-foliate *Forsstræmia*.
18. Leaves strongly falcate-secund, aquatic or growing in very
wet places
Cratoneuron, Drepanocladus, Dichelyma, Hygrohypnum.
Leaves not falcate-secund, some aquatic 19.
19. Leaves rounded at apex, obtuse or apiculate *Calliergon, Hygrohypnum*.
Leaves acute to acuminate 20.
20. Aquatic 23.
Not aquatic 21.
21. Leaves rugose *Rhytidium*.
Leaves not rugose 22.
22. Costa double or forking *Hylocomium*.
Costa single
Brachythecieæ, Hylocomium Pyrenaicum, Campylium, Drepanocladus forms.
23. Long and floating *Drepanocladus forms*.
Not long and floating 24.
24. Costa double and forking
Hygrohypnum (excl. H. Closteri and forms of H. palustre).
Costa single *Brachythecieæ, Amblystegium forms*.

CORRECTIONS

(Minor typographical errors that are in no way misleading are not noted here.)

Accents either not given or given incorrectly.

Page 64, juniperinum.	Page 138, crispum.	Page 267, Pyrenæicum.
Page 67, capillare.	Page 148, tophæus.	Page 269, rugosum.
Page 99, Bonjeani.	Page 186, striatum.	Page 272, salebrum.
Page 103, pallidum.	Page 190, luteum,	Page 277, digastrum,
Page 109, albidum.	rubrum.	acutum.
Page 122, unicolor.	Page 233, orthorrhynchum.	Page 295, Cirriphyllum.
Page 137, piliferum.	Page 240, recognitum,	Page 307, fluitans.
Page 138, Sullivantii.	Philiberti.	Page 314, Sédtneri.

The names of subfamilies are in many cases spelled with the ending "æ" instead of the correct ending "eæ," e.g., page 137, "*Weisia*" should read "*Weisieæ*." Also *Natürlichen* is spelled *Naturlichen* in several places.

Page 16, end of line 21, for "*Webera*" read "*Pohlia*."

Page 18, line 14. For "protenemata" read "protonemata." Line 3 from the bottom. For "the sex" read "these."

Page 30, line 9 of explanation. For "operculum" read "peristome."

Page 36, line 7. For "*Raphidostegium recurvans*" read "*Hypnum laxepatum*." Also page 49, second line from bottom.

Page 39, line 6 from end. For "*cribose*" read "*cribrose*."

Page 43, line 5 from bottom. For "*Hypnum rugosum*" read "*Rhytidium rugosum*."

Page 44. For "umbomate" read "umbonate." First line of note. For "22" read "23."

Page 46, line 5. For "Amlystegium" read "Amblystegium."

Page 48, section 12 of key. After "*Aulacomnium*" insert "*Bartramia Cederi*."

The Encalyptaceæ are unintentionally omitted from key. Members of this family will probably be sought under the *Tortulaceæ*.

Page 49, section 22. After "*Myurella*" insert "*Thuidium paludosum*," "*Leskea* species. Section 23. For "*Pylaisie*" read "*Entodontæ*."

Page 65, line 5. For "Piliferum" read "piliferum."

Page 67, line 15 from bottom. For "asymetric" read "asymmetric."

Page 70, line 2 from bottom. For "Fig. 2" read "Fig. 20."

Page 71, line 9 from bottom. For "*Buxbaumia's*" read "*Webera's*."

Page 80, section 4 of key. For "inflated neck" read "slender neck."

Page 81, line 13. For "25mm" read "2.5mm."

Page 84, line 4. For "5cm" read "1.5cm."

CORRECTIONS

409

Page 85, lines 8 and 11. For "*Distichum*" read "*Distichium*."

Page 86, line 5. For "confine" read "confined"; and for "and of several" read "and several." Section 1 of key, second line. After "faintly" instead of "so" read "papillose."

Page 98, line 7 below key. Before "*Sauteri*" insert "*Bergeri*."

Page 101, line 6 from bottom. For "(Hedw.)" read "Hedw."

Page 155, last line. For "1-3^{mm}" read "1-3^{cm}."

Page 169, line 11. For "Planzenfamilien" read "Pflanzenfamilien." Line 3 from bottom. For "(Hedw.)" read "Hedw."

Page 179, line 9. For "bigemminate" read "bigeminate."

Page 192, line 16 from bottom. For "*serrata*" read "*serratum*."

Page 202, section 2 of key. Interchange the descriptions of basal cells to agree with text.

Page 207, line 4. For "Gaspé" read "Gaspé."

Page 228, line 12 from bottom. Before "serrate" insert "the leaves are."

Page 238, line 10 from bottom. Omit "loosely" before "pinnately."

Page 240, line 1. For "medium" read "median."

Page 245, line 3 from bottom. For "bicostate" read "double."

Page 253, line 14 from bottom. For "abrubtly" read "abruptly." Line 7 from bottom. For "*Schuetschkea*" read "*Schwetschkea*."

Page 263, line 11. For "*Entodoneæ*" read "*Entodonteæ*." Also page 299, line 22.

Page 264, line 1 of key. For "costa strong" read "costa evident." Section 2. For "*Entodoneæ*" read "*Entodonteæ*."

Page 283, line 5. Before "rough" insert "seta."

Page 287, line 7. For "1.3-0.3^{mm}" read "1.3x0.3^{mm}."

Page 306, line 5. For "LXXII" read "LXXI."

Page 314, line 16. For "*Campylium riparium*" read "*Amblystegium riparium*." Lines 17 and 18. For "*attenuatum*" and "*intermedium*" read "*attenuatus*" and "*intermedius*."

Page 315, line 12. For "stand" read "strand."

Page 353, line 5 from bottom. For "*ubulaceum*" read "*subjulaceum*."

Page 359, line 15. For "*Rapidostegium*" read "*Raphidostegium*." Line 6 from bottom. For "*laxapatulum*" read "*laxepatulum*."

Page 373, line 10 from bottom. For "*Rothei*" read "*Ruthei*."

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